Accounting and Business Research

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Advertisement and Subscription Office:
40 Bernard Street, London WC1N 1LD, UK. Tel: 0171 833 3291. Fax: 0171 833 2085
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Parent and Subsidiary Earnings Announcements and Parent and Subsidiary Valuation

R. C. Graham, Jr. and C. E. Lefanowicz*

Abstract—A firm's earnings announcements are an important source of value relevant information to market participants. They are, however, only one such source of information. The study reported in this paper involves another source of information: the earnings announcements within pairs of parents and their majority-held subsidiaries. We examine both firms' security price reactions to both firms' earnings announcements for evidence of information flows within the pairs of firms. We find significant parent and subsidiary price reactions at their own earnings announcements only when the announcement is the first within a parent-subsidiary pair. The implication is that the first earnings announcement pre-empts some of the information released by the later announcing firm. In addition, parent firms also exhibit significant price reactions to subsidiary earnings announcements when subsidiaries announce earnings first. The magnitude of the parent price reactions suggests that incremental information is conveyed in the subsidiary earnings announcement regarding the earnings of the parents' non-subsidiary assets. The implication of this information transfer is that subsidiary earnings are particularly valuation-relevant to parent firm shareholders.

1. Introduction

This study is concerned with the information content of parent and subsidiary earnings announcements. Our first focus is on the contribution of parent and subsidiary earnings announcements to each firm's information environment. Research related to information environment suggests that the greater the information available about a firm, the smaller the price reaction at its earnings announcements. Shores (1990) and Grant (1980) show firms traded over-the-counter have larger price reactions to earnings releases than do firms listed on the New York Stock Exchange (NYSE).

In addition, Bamber (1987), Freeman (1987), and Atiase (1985) show firm size is inversely related to the unanticipated information released in earnings announcements. The implication is that more information about NYSE and larger-sized firms reaches market participants prior to their earnings releases.

Although information environment studies find significant relations between price reactions to earnings releases and variables expected to proxy for prior information releases, the studies do not examine specific prior information releases. The earnings of parents and their subsidiaries allow such an investigation because parent earnings are the sum of the earnings from its consolidated assets, of which subsidiary assets form a part. Subsidiary earnings announcements, therefore, convey some of the same information conveyed in parent earnings announcements. Similarly, parent earnings announcements convey some of the same information conveyed in subsidiary earnings announcements.

The information environment of subsidiary firms, therefore, includes the information releases of their parents. The direct relation between parent and subsidiary earnings suggests that each firm's earnings announcement is a particularly relevant source of information about the other firm's earnings.

Our second focus is on the incremental contribution of subsidiary earnings to parent valuation. Specifically, we examine whether subsidiary earnings convey information about the parent firms' non-subsidiary earnings, an issue that extends studies of information transfers (Freeman and Tse, 1992; Clinch and Sinclair, 1987; and Foster, 1981). Information transfers assume that earnings within industries are correlated. Thus, market participants can infer implications for earnings of other firms when one firm in an industry announces earnings. Information transfers will occur within a parent-subsidiary pair when a subsidiary announces earnings and market participants infer implications for earnings of the parent's non-subsidiary assets.

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Of course, this will occur if market participants can model the contribution of subsidiary earnings to the earnings of the portfolio of parent assets. For example, if subsidiary assets are similar in use to other parent assets, which is likely given that subsidiaries are acquired as part of an overall business strategy, subsidiary earnings could provide a reliable signal of the earnings from those other assets.[1]

The parent-subsidiary pair provides a unique setting to investigate information transfers because a parent's market value is the sum of the market values of its assets, including the market value of its proportionate ownership in its subsidiary. *Ceteris paribus*, the change in parent value from subsidiary earnings, in the absence of an information transfer, will be equal to the change in subsidiary value from the release of subsidiary earnings times the parent's ownership share. An information transfer, on the other hand, suggests that the change in parent value from the release of subsidiary earnings will not equal the parent's portion of the change in subsidiary value because of the information conveyed to parent shareholders regarding the parent's non-subsidiary earnings. In this study, therefore, we are able to examine information content and information transfers within the economic entity of a parent-subsidiary pair.[2]

The next section develops the hypotheses addressed in the paper. Section 3 describes the sample selection criteria, the variables used in the study, and the regression models. Results are presented in Section 4 and the last section provides a summary and a discussion of the results.

2. Hypotheses

2.1. The information content hypotheses

Earnings changes, on average, are associated with price changes (Beaver, Clarke and Wright, 1979). Because parent earnings are the sum of the earnings from its consolidated assets, of which subsidiary assets are a portion, subsidiary earnings announcements convey some of the same information conveyed in parent earnings announcements. As both parent and subsidiary earnings provide information relevant to parent valuation, we expect that both parent earnings changes and subsidiary earnings changes result in parent price changes.

We also expect that subsidiary earnings announcements provide information relevant to subsidiary valuation. The relation between parent earnings announcements and subsidiary valuation, however, will depend on the ability of market participants to disaggregate parent earnings. If market participants can disaggregate parent earnings and infer subsidiary information, then parent earnings will have valuation relevance for the remaining subsidiary shareholders. As both subsidiary and parent earnings can provide information relevant to subsidiary valuation, we expect that both subsidiary earnings changes and parent earnings changes result in subsidiary price changes.

When parent and subsidiary earnings are released on different dates, however, the earnings announcements of the first announcing firm will affect the unanticipated information released in the second earnings announcement. Market participants will update their valuations of a parent firm when their subsidiary releases earnings prior to the parent's earnings announcement. The parent's earnings, therefore, which have value relevance to both the parent and the subsidiary shareholders, will be more informative than they otherwise would be if the parent's earnings had been released second. Similarly, market participants will update their valuation of a subsidiary when its parent releases earnings prior to the subsidiary's earnings announcement. Panels A and B of Figure 1 illustrate the two possible orders of earnings announcements within a parent-subsidiary pair. Panel A illustrates when a subsidiary announces earnings before its parent and Panel B illustrates when a parent announces earnings before its subsidiary.

The two types of earnings announcers (parent and subsidiary) and the two possible orders of announcement (parent first and subsidiary first) result in eight possible information flows. To keep track of the logic of our hypotheses when our regression variables are explained later in the paper, Figure 1 also includes our variable nomenclature. We denote the earnings information released by each firm as NEWS, with labels for both the source and the target of the earnings information. The source of the earnings is the announcing firm, either the parent (P) or the subsidiary (S). Thus, PNEWS represents the information released in parent earnings announcements and SNEWS represents the information released in subsidiary earnings announcements.

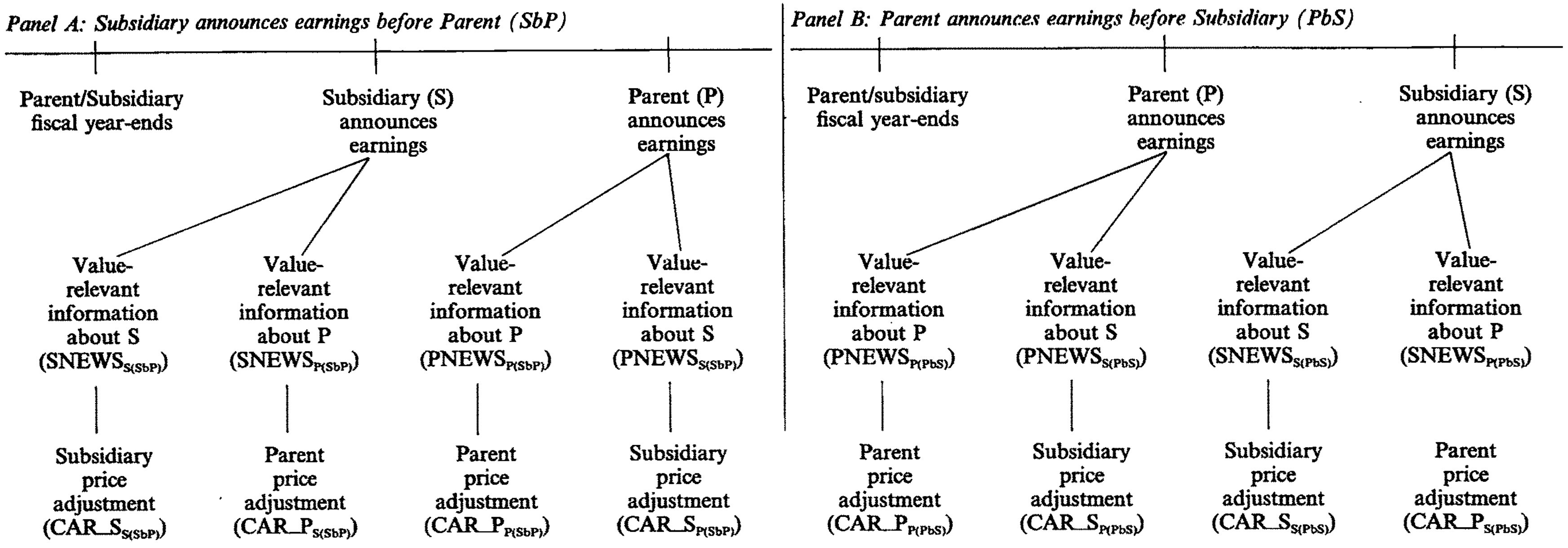
The target is the firm whose value will be updated by the information released in the earnings announcement. We designate targets with either subscript P (signifying that the information released is relevant to parent valuation) or subscript S (signifying that the information released is relevant to subsidiary valuation). $PNEWS_P$ and $SNEWS_P$, therefore, represent parent and subsidi-

---

[1] Information transfers could also occur when parents own diversified assets. All that is required is that market participants can model the contribution of subsidiary earnings to the earnings of the parent's portfolio of assets.

[2] Although the two firms are separate legal entities, the parent-subsidiary relationship is an economic entity because the parent's majority ownership gives it control over the operating, financing and investing policies of its subsidiary.

Figure 1
Illustration of the information content hypotheses


Panel A: Subsidiary announces earnings before Parent (SbP)
Parent/Subsidiary fiscal year-ends
Subsidiary (S) announces earnings
Parent (P) announces earnings
Value-relevant information about S (SNEWS_S(SbP))
Value-relevant information about P (SNEWS_P(SbP))
Value-relevant information about P (PNEWS_P(SbP))
Value-relevant information about S (PNEWS_S(SbP))
Subsidiary price adjustment (CAR_S_S(SbP))
Parent price adjustment (CAR_P_S(SbP))
Parent price adjustment (CAR_P_P(SbP))
Subsidiary price adjustment (CAR_S_P(SbP))
Panel B: Parent announces earnings before Subsidiary (PbS)
Parent/subsidiary fiscal year-ends
Parent (P) announces earnings
Subsidiary (S) announces earnings
Value-relevant information about P (PNEWS_P(PbS))
Value-relevant information about S (PNEWS_S(PbS))
Value-relevant information about S (SNEWS_S(PbS))
Value-relevant information about P (SNEWS_P(PbS))
Parent price adjustment (CAR_P_P(PbS))
Subsidiary price adjustment (CAR_S_P(PbS))
Subsidiary price adjustment (CAR_S_S(PbS))
Parent price adjustment (CAR_P_S(PbS))

Panel C: Information Content Hypotheses

H_{A1}: $PNEWS_{P(SbP)} < PNEWS_{P(PbS)}$
H_{A2}: $SNEWS_{P(SbP)} > SNEWS_{S(PbS)}$
H_{A3}: $SNEWS_{S(SbP)} > SNEWS_{P(PbS)}$
H_{A4}: $PNEWS_{S(SbP)} < PNEWS_{S(PbS)}$

ary earnings releases relevant to parent valuation, and $PNEWS_S$ and $SNEWS_S$ represent parent and subsidiary earnings releases relevant to subsidiary valuation. We add the subscript timing designations (SbP) or (PbS) to identify the relative order of the earnings announcements in our hypotheses.

Panel C of Figure 1 shows the information content hypotheses using the variable nomenclature described in the preceding paragraph. The information content hypotheses are formalised in the alternative form as:

> H_{A1}: Parent earnings announcements provide more value relevant information to parent shareholders when they occur before their subsidiary's earnings announcements than when parent company earnings announcements occur after their subsidiary's earnings announcements (i.e. $PNEWS_{P(PbS)} > PNEWS_{P(SbP)}$).
>
> H_{A2}: Subsidiary earnings announcements provide more value relevant information to parent shareholders when they occur before their parent's earnings announcements than when subsidiary earnings announcements occur after their parent's earnings announcements (i.e. $SNEWS_{P(SbP)} > SNEWS_{P(PbS)}$).
>
> H_{A3}: Subsidiary earnings announcements provide more value relevant information to subsidiary shareholders when they occur before their parent's earnings announcements than when subsidiary earnings announcements occur after their parent's earnings announcements (i.e. $SNEWS_{S(SbP)} > SNEWS_{S(PbS)}$).
>
> H_{A4}: Parent earnings announcements provide more value relevant information to subsidiary shareholders when they occur before their subsidiary's earnings announcements than when parent company earnings announcements occur after their subsidiary's earnings announcements (i.e. $PNEWS_{S(PbS)} > PNEWS_{S(SbP)}$).

2.2. *The information transfer hypothesis*

The information content hypotheses focus on the information content of parent and subsidiary earnings announcements. The information transfer hypothesis extends that focus to whether subsidiary earnings provide incremental information relevant to the parent's non-subsidiary earnings. A maintained hypothesis is that a parent's market value is the sum of the market value of its assets. A change in subsidiary market value attributed to the release of subsidiary earnings, therefore, should be accompanied by an equivalent change in the parent's market value.

Consider, however, the relation between subsidiary earnings released first and parent valuation. If the subsidiary's earnings announcement provides any information for parent valuation over that represented by the subsidiary's price change, the subsidiary earnings information is likely to relate to the parent's non-subsidiary operations. If so, then the change in parent market value will not be proportional to the change in subsidiary market value. The information transfer hypothesis is formalised in the alternative form as:

> H_{A5}: Subsidiary earnings announcements provide value-relevant information to parent shareholders regarding the earnings from the parent's non-subsidiary assets.

3. Research method

3.1. *The parent-subsidiary sample*

The sample is limited by the availability of publicly-traded parents with publicly-traded majority-held subsidiaries. To obtain the sample, CDA Investment Technologies's *Spectrum 5* and the *Directory of Corporate Affiliations* were examined for any majority-held subsidiaries during the years 1983 through 1992. A subsidiary was classified as majority-owned if at least 50.1% was held by its parent. The parents and their majority-owned subsidiaries were selected if both were listed on either the NYSE or the AMEX during the period of majority ownership, and majority ownership existed for at least two consecutive years.

This procedure identified 81 parent-subsidiary pairs. The *Wall Street Journal Index* (*WSJI*) was searched for parent and subsidiary firm-specific announcements. Eliminating the firm pairs where either the parent's or the subsidiary's earnings data was unavailable reduced the sample by 41 pairs. Other parent-subsidiary pairs consistently announced earnings concurrently. Eliminating those pairs reduced the sample to 27 parent-subsidiary pairs.[3] Panel A of Table 1 lists the parents and subsidiaries and their industry affiliations and Panel B illustrates the results of the sample selection process.

The earnings announcement dates of the remaining 27 pairs were obtained from the *WSJI.* Any parent or subsidiary earnings announcement made within two days of any other announcement, either its own or its affiliate's, was excluded from the sample. These exclusions caused the number of

---

[3] For comparison, Holderness and Sheehan (1988) found 29 publicly-traded subsidiaries with publicly-traded parents. Holderness and Sheehan (1988) and also Schipper and Smith (1986) discuss reasons for the existence of publicly-traded majority-owned subsidiaries, including providing external financing for subsidiary investment projects, attaching managerial compensation to subsidiary market value, and keeping founders or family members involved.

Table 1
The sample and the results of the selection process

Panel A: The parent and subsidiary firms

Parent firms	*Parent SIC*	*Ownership %*	*Subsidiary firms*	*Subsidiary SIC*
American Capital	6522	66	Transcapital Financial	6711
American Maize Products	2046	58	American Fructose	2046
American Motor Inns	7011	81	Universal Communications	4811
Artra Group	3691	73	Lori Corporation	3861
Ashland Oil	2911	65	Ashland Coal	1222
Berkshire Hathaway	2064	80	Wesco Financial	6122
Chyron Corporation	3662	60	C M X Corporation	3861
Clabir Corporation	3351	83	AmBrit	2024
Clabir Corporation	3351	51	General Defense	3356
Clabir Corporation	3351	76	Isaly	5812
D W G Corporation	6711	51	Southeastern Public Service	2097
Electro Audio	3613	82	Technodyne	3679
Helm Resources	4941	51	Bamberger Polymers	2641
Intermark	3462	52	Mission West Financial	6162
Intermark	3462	52	Anthem Electronics	5065
Katy Industries	6711	52	HMW Industries	3873
Loews Corporation	2111	83	C N A Financial	6321
Murphy Oil	2911	59	Ocean Drilling & Exploration	1381
National Patent	2821	90	International Hydron	3851
Newmont Mining	1382	89	Foote Mineral	3313
Pacific Gas & Electric	4911	51	Pacific Gas Transmission	4922
Pacificorp	4911	91	Nerco	1111
Primerica Corporation	3411	83	American Capital	6522
Primerica Corporation	3411	81	Musicland Group	5733
Standard Shares	6712	51	Pittway Corporation	3499
Starrett Housing	1622	80	Levitt Corporation	1521
Thermo Electron	3621	80	Thermedics	2834

Panel B: The selection process

Initial parent-subsidiary sample[a]	81
Parent-subsidiary pairs excluded because of missing earnings data	(41)
Parent-subsidiary pairs excluded because of confounded announcements	(13)
Parent-subsidiary pairs represented in final sample	**27**
Total number of parent earnings announcements	**206**
Total number of subsidiary earnings announcements	**235**

[a] The shares represent majority ownership positions. Both the parent and subsidiary are required to be listed on the NYSE or AMEX.

parent and subsidiary announcements to slightly differ, even though the same firm pairs are represented in both samples. The final sample contains 206 parent and 235 subsidiary unconfounded earnings announcement dates. The earnings announcement dates were analysed to determine the parent and subsidiary announcement order. For the 206 parent earnings announcements, 44 occurred prior to and 162 occurred after the subsidiary disclosed its earnings. For the 235 subsidiary earnings announcements, 191 occurred prior to and 44 occurred after the parent disclosed its earnings. The median number of days between parent and subsidiary earnings announcements is seven.

3.2. Security returns

Standard event study methods are used to calculate parent and subsidiary abnormal security returns for each of the earnings announcement dates. The return generating mechanism assumed is:

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it}. \tag{1}$$

Abnormal security returns are defined as

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}), \tag{2}$$

where:

R_{it} = return for security i at time t,
R_{mt} = return on the CRSP value-weighted market portfolio at time t,
$\hat{\alpha}_i, \hat{\beta}_i$ = regression coefficients,
e_{it} = residual for security i at time t, and
AR_{it} = the abnormal security return for security i at time t.

The estimation period is day -240 to day -2, with the *WSJI* announcement date defined as day 0. The *CRSP* daily returns file and the *CRSP* value-weighted market index were used as sources of returns data. AR_{it} is calculated for the day before and the day of each announcement appearing in the *WSJI* and summed to yield a cumulative two-day abnormal security return (CAR).[4] We label the two-day returns in a manner similar to our labelling of earnings information.

3.3. Earnings news

An investigation of the valuation effects of parent and subsidiary earnings announcements requires four measures of earnings news. Two of the measures represent parent and subsidiary news from their own earnings, and the remaining two measures represent news from each others' earnings. To compute the four measures, earnings change variables are first calculated for each parent and subsidiary earnings announcement. Earnings changes are calculated using a seasonal random walk model with quarterly earnings per share of one year earlier designated as expected earnings. The earnings change variables are calculated as follows:

$$\mathrm{ECHANGE}_{P(S)} = \mathrm{EPS}_{P(S),\,T} - \mathrm{EPS}_{P(S),\,T-4}, \qquad (3)$$

where:

$\mathrm{ECHANGE}_{P(S)}$ = the parent (P) or subsidiary (S) quarterly change in earnings from one year earlier, and
$\mathrm{EPS}_{P(S)}$ = actual reported parent or subsidiary earnings per share in quarters T and T–4.

3.4. Parent and subsidiary news from their own earnings announcements

To reflect the impact of the parent and subsidiary earnings change on their own share prices, the applicable ECHANGE variables are standardised by beginning of the quarter share price. Thus:

$$\mathrm{PNEWS}_P = \frac{\mathrm{ECHANGE}_P}{P_P} \text{ and}$$

$$\mathrm{SNEWS}_S = \frac{\mathrm{ECHANGE}_S}{P_S}, \qquad (4)$$

where:

PNEWS_P = the parent news from its own (consolidated) earnings,
SNEWS_S = the subsidiary news from its own earnings, and
$P_{P(S)}$ = the parent (P) or subsidiary (S) security price on the first day of the quarter.

3.5. Parent news from subsidiary earnings announcements

To reflect the impact of the subsidiaries' earnings changes on their parents' share prices, subsidiary earnings changes are modified to reflect the relation between subsidiary earnings and parent valuation. The earnings changes are first multiplied by the number of outstanding subsidiary shares and the ownership percentage to provide a proxy for the subsidiary earnings allocated to the parent and then divided by the number of outstanding parent shares for a parent per share measure.[5] Finally, the per share measure is standardised by beginning of the quarter share price. Thus:

---

[4] To test the sensitivity of the results of this procedure, a risk-adjusted return was calculated using a different method. Each firm was assigned to one of 10 aggregate portfolios based on the firm's beta, calculated for the prior calendar year using the method found in Scholes and Williams (1977). Then risk-adjusted daily returns were calculated by subtracting the average return of the appropriate beta portfolio from the raw return for that firm. The results using this approach are similar to those reported later in the study.

In addition, we investigated whether our results were affected by thinly-traded subsidiaries. We collected daily trading volume during the 240-day estimation period and the two-day announcement period from the *CRSP* tapes for each subsidiary. Next we arbitrarily identified a subsidiary as not actively traded if there were no shares traded for at least 24 days (10%) during the 240-day estimation period. Of the 27 subsidiaries, six were identified as not actively traded. To assess the effect of these thinly-traded subsidiaries on our regression results we repeated each of the subsequent regressions involving a subsidiary price change after deleting these six subsidiary firms. The results of these replications are similar to those presented in the paper. Finally, there were no instances in which a subsidiary's price change was calculated for a two-day announcement period for which there were no shares traded.

Finally, our results could also be affected by the size of and differences in the size of the parents and subsidiaries in our sample. To investigate the effect of size on our regressions we added as independent variables first the log of the market value of common equity, and second the market value ratio (market value of the subsidiary owned by the parent divided by the market value of the parent). The replications involving both of these variables produced results similar to those reported in the paper.

$$\mathrm{SNEWS_P} = \frac{\dfrac{\mathrm{ECHANGES_S * SSHARES * OP}}{\mathrm{PSHARES}}}{\mathrm{P_P}}, \qquad (5)$$

where:

$\mathrm{SNEWS_P}$ = parent news from subsidiary earnings,

S(P)SHARES = the number of subsidiary (parent) common shares outstanding, and

OP = the percentage of subsidiary shares owned by the parent.

3.6. Subsidiary news from parent earnings announcements

The subsidiary news available from parent earnings is not clear because subsidiary earnings are aggregated with other parent earnings. In this study, we assume that subsidiary earnings news inferred from parent earnings is proportional to the ratio of the parent's share of the subsidiary's market value to the parent's market value. The resulting news variable is again standardised by beginning of the quarter share price. Thus:

$$\mathrm{PNEWS_S} = \frac{\mathrm{ECHANGE_P} * \dfrac{\mathrm{MV_S * OP}}{\mathrm{MV_P}}}{\mathrm{P_S}}, \qquad (6)$$

3.7 The information content regression models

Two sets of regression models test the relation between parent and subsidiary earnings releases and parent and subsidiary security returns while controlling for announcement timing. The regression models use a method of combining related regressions with a dummy variable as described in Neter, Wasserman and Kutner (1983: 337–339). The first set of regressions (equations 7 and 8) investigates parent valuation in testing Hypotheses 1 and 2. Equation 7 compares parent share price effects to parent earnings announcements occurring before and occurring after their subsidiaries announce earnings (H_{A1}). Equation 8 compares parent share price effects to subsidiary earnings announcements occurring before and occurring after their parents announce earnings (H_{A2}).

$$\mathrm{CAR\_P_P} = \alpha + \beta_1(\mathrm{PNEWS_P}) + \beta_2(\mathrm{D1*PNEWS_P}) + e \qquad (7)$$

$$\mathrm{CAR\_P_S} = \alpha + \beta_1(\mathrm{SNEWS_P}) + \beta_2(\mathrm{D2*SNEWS_P}) + e \qquad (8)$$

Expected signs (+) (−)

where:

$\mathrm{CAR\_P_P}$ = parent cumulative two-day abnormal security return at its own earnings announcement,

$\mathrm{CAR\_P_S}$ = parent cumulative two-day abnormal security return at its subsidiary's earnings announcement,

$\mathrm{PNEWS_P}$ = parent news from parent earnings,

$\mathrm{SNEWS_P}$ = parent news from subsidiary earnings,

D1 = a dummy variable equalling one if the parent earnings announcement occurs after the subsidiary announcement and zero otherwise, and

D2 = a dummy variable equalling one if the subsidiary earnings announcement occurs after the parent announcement and zero otherwise.

In equation 7, the β_1 coefficient represents the relation between parent abnormal returns and their own earnings announcements when the parent announces first. The β_2 coefficient represents the difference in that relation when the parent announces earnings after its subsidiary. Thus, β_1 represents the $\mathrm{PNEWS_{P(PbS)}}$ and β_2 represents the difference between the $\mathrm{PNEWS_{P(PbS)}}$ and the $\mathrm{PNEWS_{P(SbP)}}$. In a similar manner, β_1 in equation 8 represents the $\mathrm{SNEWS_{P(SbP)}}$ and β_2 represents the difference between the $\mathrm{SNEWS_{P(SbP)}}$ and the $\mathrm{SNEWS_{P(PbS)}}$.

The second set of regressions investigates subsidiary valuation in testing Hypotheses 3 and 4. Equation 9 compares subsidiary share price effects to subsidiary earnings announcements occurring before and occurring after their parents announce earnings (H_{A3}). Equation 10 compares subsidiary share price effects to parent earnings announcements occurring before and occurring after their subsidiaries announce earnings (H_{A4}).

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[5] The actual earnings recognised by the parent reflect the elimination of intercompany profits. We assume, for purposes of this study, that the nature of the eliminations is unavailable to market participants at the time of a parent or subsidiary earnings announcement. In addition, a review of each firm's Securities and Exchange Commission 10-K filing found no significant customer relationships within any of the parent-subsidiary pairs.

$$CAR\_S_S = \alpha + \beta_1(SNEWS_S) + \beta_2(D2{*}SNEWS_S) + e \quad (9)$$

$$CAR\_S_P = \alpha + \beta_1(PNEWS_S) + \beta_2(D1{*}PNEWS_S) + e \quad (10)$$

Expected signs (+) (−)

where:

CAR_S_S = subsidiary cumulative two-day abnormal security return at its own earnings announcement,

CAR_S_P = subsidiary cumulative two-day abnormal security return at its parent's earnings announcement,

$SNEWS_S$ = subsidiary news from subsidiary earnings,

$PNEWS_S$ = subsidiary news from parent earnings, and

D1 and D2 are as previously defined.

In equation 9, β_1 represents the relation between subsidiary abnormal returns and their own earnings announcements when the subsidiary announces first, and β_2 represents the difference in that relation when the subsidiary announces earnings after its parent. Thus, β_1 represents the $SNEWS_{S(SbP)}$ and β_2 represents the difference between the $SNEWS_{S(SbP)}$ and the $SNEWS_{S(PbS)}$ illustrated by Figure 1. In equation 10, β_1 represents the $PNEWS_{S(SbP)}$ and β_2 represents the difference between the $PNEWS_{S(SbP)}$ and the $PNEWS_{S(PbS)}$.

Parent and subsidiary earnings announcements are expected to have own-firm and cross-firm implications when they are the first announcement within a parent-subsidiary pair. The β_1s are therefore expected to be positive in all four regressions. Our hypotheses predict that parent and subsidiary earnings will have more own-firm and cross-firm valuation implications when they are the first release of earnings within the parent-subsidiary pair. As the β_2 coefficients represent the difference in the price-earnings relations between announcements made first and announcements made second, the β_2s are expected to be negative in all four regressions.

3.8. The information transfer regression model

The information transfer hypothesis predicts that subsidiary earnings have value relevance for parents' non-subsidiary assets. We employ a two-stage regression to test this hypothesis. A two-stage regression approach has been used in prior research to investigate whether a particular variable provides additional explanatory power over that contained in another variable. For example, Beaver, Griffin and Landsman (1982) use a two-stage regression methodology to determine whether an earnings variable based on Accounting Series Release No. 190 (replacement cost earnings) provides incremental information content over that provided by historical cost earnings.[6]

Equations 11a and 11b present the two stages in our information transfer regression model. We limit our analysis to the 191 subsidiary announcements occurring first in the parent-subsidiary pairs because information transfers are most likely before the parent announces its own earnings.

First Stage: $SNEWS_{P(SbP)} =$

$$\alpha + \beta_1 (Relative\_Size{*}CAR\_S_S) + RESID \quad (11a)$$

Second Stage: $CAR\_P_S =$

$$\alpha + \beta_1 (Relative\_Size{*}CAR\_S_S) + \beta_2 RESID + e \quad (11b)$$

The variables in equations 11a and 11b are as defined in the information content hypotheses with the exception of Relative_Size and RESID. Relative_Size adjusts CAR_S_S to correspond to the contribution of subsidiary price changes to parent price changes. This adjustment is needed because the parents own less than 100% of the subsidiaries in our sample and because the parent and subsidiaries are of different sizes. This adjustment is accomplished using a procedure in Graham and Lefanowicz (1996) that adjusts CAR_S_S by the parent's ownership percent multiplied by the ratio of subsidiary market value to parent market value, referred to as Relative_Size.[7]

In the first stage, we regress the earnings news applicable to the parent from the subsidiary's earnings announcement ($SNEWS_{P(SbP)}$) on the Relative_Size adjusted subsidiary price change (Relative_Size*CAR_S_S). RESID is the residual obtained from the first stage regression and therefore represents the information in $SNEWS_{P(SbP)}$ not explained by Relative_Size adjusted CAR_S_S. RESID, therefore, is by construction uncorrelated with Relative_Size*CAR_S_S. The second stage regresses the parent's price change (CAR_P_S) on Relative_Size*CAR_S_S and RESID. If Hypothesis 5 holds and the information applicable to parents from subsidiary earnings provides incremental information, β_2 will be significantly different from zero.[8]

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[6] As highlighted in Beaver, Griffin and Landsman (1984), there are three econometrically equivalent approaches to testing the significance of an added explanatory variable: (1) an F-test on the reduction in residual variance from adding the additional variable; (2) a single regression with both variables included as explanatory variables; and (3) a two-stage regression approach. They argue that the two-stage is preferable in their setting of historical cost and replacement cost earnings because it focuses on the incremental nature of replacement cost earnings.

[7] Graham and Lefanowicz (1996) calculate the Relative_Size adjustment factor to equate the returns of investors and investees, but the factor is equally applicable to parent and subsidiary pairs. If the return (R) to a subsidiary (S) at time t+1 is defined as $R_{St+1} = (Value_{St+1} - Value_{St})/(Value_{St})$, then the return to the parent will be $R_{Pt+1} = OP(Value_{St+1} - Value_{St})/(Value_{Pt})$. Solving for $(Value_{St+1} - Value_{St})$ for the return to a subsidiary and substituting the result into the return to the parent produced $R_{Pt+1} = (R_{St+1})(OP)(Value_{St}/Value_{Pt})$.

4. Results

4.1. Descriptive statistics

Table 2 presents descriptive statistics for the parent and subsidiary pairs and the variables used in this study. The ownership percentage ranges from 51.00 to 91.00 with a mean of 69.22 and a median of 70.64. The market values of both types of firms are relatively large, ranging from \$27m to \$15,498m with a median of \$508m for parents, and from \$15m to \$13,344m with a median of \$147m for subsidiaries. The market value ratios—subsidiary market value owned by the parent divided by parent market value—have a mean of 0.301, a median of 0.249, and a range from 0.018 to 0.780. The market value ratios show the subsidiaries are a significant portion of the parents' market values although the median market value ratio of 0.249 implies parents own substantial other assets.

Panels B and C present descriptive statistics of the cumulative abnormal returns and earnings news variables around parent and subsidiary earnings announcements. The median values for the returns variables and the earnings variables are essentially zero in both panels. The ranges of the returns variables in both panels are similar, although somewhat larger at subsidiary earnings announcements than at parent earnings announcements. The ranges of the four earnings variables are also generally similar except for the smaller range of the subsidiary news to subsidiary valuation ($SNEWS_S$) variable.

4.2. Parent price-earnings relations: tests of Hypotheses 1 and 2

Table 3 presents the regressions of parent abnormal security returns on measures of parent and subsidiary earnings news. The coefficients relating parent security returns to parent earnings announcements made first (β_1 in Panel A) and to subsidiary earnings announcements made first (β_1 in Panel B) are both positive and significant ($t = 1.70$, p-value ≤ 0.0450 and $t = 9.43$, p-value ≤ 0.0001).[9] The significant positively signed β_1 coefficients show the importance of both parent and subsidiary earnings announcements to parent valuation. This suggests subsidiary earnings have valuation implications similar to parent earnings.[10] In addition, the adjusted R^2 of 27.6% suggests subsidiary earnings add an especially important source of information to market participants' knowledge of parent earnings.

The results in Table 3 show the price-earnings relations depend upon which firm announces earnings first. The coefficients representing differences in the price-earnings relations between parent announcements made before and after subsidiary announcements (β_2 in Panel A) and subsidiary announcements made before and after parent announcements (β_2 in Panel B) are both negative and significant ($t = -2.16$, p-value ≤ 0.0159 and $t = -1.78$, p-value ≤ 0.0382).

Recall that Hypotheses 1 and 2 formalised our expectation that parent and subsidiary earnings announcements made first provide more value-relevant information than do announcements made second. Because the sum of β_1 and β_2 econometrically is equivalent to the price-earnings relations at announcements occurring second, the signifi-

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[8] Insightful readers will note that our two-stage regression does not capture the interdependencies among changes in parent and subsidiary earnings and share prices. Consider, for example, that equations 11a and 11b imply the two related equations:

$$CAR\_P_S = \alpha + \beta_1 SNEWS_P + \beta_2 \, Relative\_Size{*}CAR\_S_S + \varepsilon \quad (12a)$$

and

$$Relative\_Size{*}CAR\_S_S = a + b_1 SNEWS_P + e. \quad (12b)$$

The simultaneous determination of both CAR_P_S and Relative_Size*CAR_S_S by $SNEWS_P$ suggests that our analysis should be extended to a system of simultaneous equations (the 3SLS estimation technique described in Theil (1971: 508–513, for example). Simultaneous equation estimation, however, requires that equation 12b contain a variable which does not occur in equation 12a, a condition not met in our system (Theil 1971: 430). It is possible, therefore, that interdependencies remain that are not compensated for by our two-stage regression and thus our parameter estimates are inconsistent.

[9] The results of these and subsequent regressions are not adversely affected by either multicollinearity or outliers. The standard cutoff rules identified in Belsley, Kuh and Welsch (1980) do not indicate any unduly influential observations.

The regression results, however, are possibly affected by interdependencies caused by multiple observations for each parent-subsidiary pair. If interdependencies are present, low variations in correlations within the pairs cause a downward bias in the estimates of the standard errors. For this reason, the standard errors in the regressions were recalculated using a method developed in Froot (1989). The Froot technique averages the observed standard errors within each parent-subsidiary pair. The resulting adjusted standard errors are qualitatively similar to those reported in the tables, thus suggesting the results are not affected by interdependencies within the parent-subsidiary pairs.

[10] It is also possible that these results occur because the firms' production processes and security returns are related regardless of any investment relation. King (1966) and Livingston (1977) find that security returns of firms within the same industry are positively related. In addition, Foster (1981) and Clinch and Sinclair (1987) find that firms with similar products have correlated security returns around their earnings announcements. The regressions are replicated after excluding any of the pairs in which both parent and subsidiary have the same two-digit SIC codes. The results of the replication are qualitatively similar to those shown in the paper.

Table 2
Descriptive statistics of selected parent and subsidiary variables[a]

	Mean	*Median*	*Standard deviation*	*Maximum*	*Minimum*
Panel A: Parent and subsidiary attributes (N=27)					
Ownership percentage	69.22	70.64	14.47	91.00	51.00
Market value - subsidiary	\$995	\$147	\$2,720	\$13,344	\$15
Market value - parent	\$2,642	\$508	\$4,199	\$15,498	\$27
Market value ratio	0.301	0.249	0.223	0.780	0.018
Panel B: Parent earnings announcement variables (N=206)					
CAR_P$_p$	0.001	−0.001	0.044	0.199	−0.184
CAR_S$_p$	0.004	0.000	0.044	0.211	−0.215
PNEWS$_p$	−0.003	−0.000	0.093	0.538	−0.680
PNEWS$_s$	0.007	−0.000	0.071	0.581	−0.409
Panel C: Subsidiary earnings announcement variables (N=235)					
CAR_S$_s$	0.006	−0.000	0.052	0.235	−0.209
CAR_P$_s$	−0.002	−0.002	0.055	0.343	−0.391
SNEWS$_s$	−0.005	0.000	0.040	0.141	−0.199
SNEWS$_p$	−0.007	0.000	0.087	0.569	−0.967

[a]Ownership percentage is the percentage of voting shares of the subsidiary held by the parent.
Market value equals the number of common shares outstanding times the closing price per share plus the book value of debt (shown in millions).
Market value ratio equals the market value of the subsidiary multiplied by the percentage ownership and divided by the market value of the parent.

CAR_P$_p$ = parent cumulative two-day abnormal security return at its own earnings announcement.
CAR_S$_p$ = subsidiary cumulative two-day abnormal security return at its parent earnings announcement.
PNEWS$_p$ = parent news from parent earnings
PNEWS$_s$ = subsidiary news from parent earnings.
CAR_S$_s$ = subsidiary cumulative two-day abnormal security return at its own earnings announcement.
CAR_P$_s$ = parent cumulative two-day abnormal security return at its subsidiary earnings announcement.
SNEWS$_s$ = subsidiary news from subsidiary earnings.
SNEWS$_p$ = parent news from subsidiary earnings.

cant negatively signed β_2 coefficients suggest support for those two hypotheses.

An F-test of whether the sum of β_1 and β_2 in Panel A (0.2639 + −0.3431) equals zero rejects the null hypothesis of no difference (F = 5.53, p-value $\leq$ 0.0196). This suggests a negative price reaction to parent earnings announcements when parent earnings are announced second. We investigate the negative relation further in the next section. An F-test of whether the sum of β_1 and β_2 in Panel B (0.3309 + −2.4847) equals zero finds no significant price-earnings relation when a parent announces after its subsidiary (F = 2.37, p-value $\leq$ 0.1243).[11] This suggests no new valuation relevant information is released for parent shareholders from subsidiary earnings announcements made after a parent has released its own earnings.

4.3. *Parent price reactions to non-subsidiary earnings*

Because the parents' earnings include more than their subsidiaries' earnings, the inverse reaction (shown in Panel A, Table 3) when parent earnings are announced second could be attributed to either their subsidiaries' earnings or to the parents' non-subsidiary earnings. To directly tie parent price changes to the announcement of non-subsidiary earnings, we update the expectations of parent earnings to reflect the new information conveyed

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[11] Even though the two coefficients appear quite different, their sum is not significantly different from zero. This may be due to either a small earnings change variance or to the small number of observations for subsidiaries announcing earnings after the parent. Analysis of the data shows that the earnings news variables represented in this coefficient only range from −0.02 to +0.02. The relatively small number of observations represented by this coefficient (n = 44) may, however, partially explain the small variance.

Table 3
The relation between parent abnormal security returns and parent earnings announcements and subsidiary earnings announcements[a]

Panel A: parent returns around parent earnings announcements

$$CAR\_P_p = \alpha + \beta_1(PNEWS_p) + \beta_2(D1 * PNEWS_p) + e$$

Parameters	*Expected sign*	*Estimates*	*t– statistic*	*P– value*	*Standard error*
Intercept	?	0.0020	0.65	0.5158[b]	0.003
β_1	+	0.2639	1.70	0.0450[c]	0.155
β_2	–	–0.3431	–2.16	0.0159[c]	0.159

$n = 206$; $F = 4.22$; p-value < 0.0160; adjusted $R^2 = 0.031$

Panel B: Parent returns around subsidiary earnings announcements

$$CAR\_P_s = \alpha + \beta_1(SNEWS_p) + \beta_2(D2 * SNEWS_p) + e$$

Parameters	*Expected sign*	*Estimates*	*t– statistic*	*P– value*	*Standard error*
Intercept	?	–0.0003	–0.11	0.9130[b]	0.003
β_1	+	0.3309	9.43	0.0001[c]	0.035
β_2	–	–2.4847	–1.78	0.0382[c]	1.396

$n = 235$; $F = 45.722$; p-value $\leqslant 0.0001$; adjusted $R^2 = 0.276$

[a] CAR_P_p = parent cumulative two-day abnormal security return surrounding its own earnings announcements.

CAR_P_s = parent cumulative two-day abnormal security return surrounding its subsidiary's earnings announcements.

$PNEWS_p$ = parent earnings news calculated as the change in parent quarterly earnings per share from one year earlier divided by parent beginning of quarter share price.

$SNEWS_p$ = parent earnings news calculated as the change in subsidiary quarterly earnings per share from one year earlier, multiplied by the number of subsidiary shares outstanding and the ownership percent and divided by the number of parent shares outstanding and by parent beginning of quarter share price.

D1 = a dummy variable equalling one if the parent earnings announcement occurs after the subsidiary announcement and zero otherwise.

D2 = a dummy variable equalling one if the subsidiary earnings announcement occurs after the parent announcement and zero otherwise.

[b] Two-tailed

[c] One-tailed

when a parent announces earnings second. This variable is calculated by subtracting the earlier announced subsidiary earnings applicable to the parents from the parent's earnings change (i.e. $PNEWS_P$–$SNEWS_P$). We then regress the parent's price changes on the updated parent earnings. The results are shown in Table 4.

The coefficient representing the updated parent earnings news (β_1) is not significant ($t = -1.28$, p-value ≤ 0.2014). This suggests market participants are receiving no unanticipated information about parents' other earnings when the parent announces earnings after its subsidiary. It follows that the earnings expectations of parent shareholders were updated prior to the parents' earnings announcements. Of course, one possible source of information updating parent shareholders' earnings expectations is the prior subsidiary earnings announcement.[12]

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[12] A similar regression with updated subsidiary news (relevant to the regression in Panel B of Table 3) was run with no significant results. In addition, both Table 3 regressions were run after substituting updated parent news (Panel A) and updated subsidiary news (Panel B) for the second announcing firm earnings variables. Finally, separate regressions for the four

Table 4
The relation between parent abnormal security returns and updated parent earnings[a]

$$CAR\_P_p = \alpha + \beta_1(UPNEWS_p) + e$$

Parameters	*Expected sign*	*Estimates*	*t – statistic*	*P – value*	*Standard error*
Intercept	?	0.0029	0.82	0.4136[b]	0.004
β_1	+	−0.0560	−1.28	0.2014[b]	0.044

$n = 162$; $F = 1.646$; p-value $\leqslant 0.2014$; adjusted $R^2 = 0.004$

[a] CAR_P_p = parent cumulative two-day abnormal security return surrounding its own earnings announcements.
$UPNEWS_p$ = parent earnings news calculated as the difference between the change in parent earnings attributable to the parent from the change in subsidiary earnings and parents' announced earnings, divided by parent beginning of quarter share price (i.e. $PNEWS_p$ - $SNEWS_p$).
[b] Two-tailed

4.4. Subsidiary price-earnings relations: tests of Hypotheses 3 and 4

Table 5 represents the regressions of subsidiary abnormal security returns on parent and subsidiary measures of earnings news. The regression results in Panel A provide support for our third hypothesis as well as providing further evidence that announcements made first release more information than do announcements made second. The coefficient representing subsidiary earnings news for subsidiary earnings announcements made first (β_1) is positive and highly significant ($t = 3.62$, p-value ≤ 0.0002). The coefficient representing the difference in price-earnings relations when subsidiary earnings are announced after their parents' earnings (β_2) is negative and significant ($t = -1.79$, p-value ≤ 0.0375). An F-test of whether the sum of β_1 and β_2 ($0.3357 + -0.3860$) equals zero fails to find a significant price-earnings relation for subsidiary announcements made second ($F = 0.07$, p-value ≤ 0.7968).

Even though the results in Panel A suggest that subsidiary shareholders update their earnings expectations when parent earnings are announced, the results in Panel B show no significant relation between parent earnings announcements and subsidiary abnormal security returns. The lack of significance of this regression is puzzling, but may reflect the difficulty market participants have in disaggregating subsidiary earnings from parent earnings announcements.[13] Thus, our two-day announcement window may not be long enough to capture the assimilation of information by subsidiary shareholders. The result also may be caused by our misspecification of the news variable. Alternate specifications of the subsidiary earnings variable calculated from parent earnings, however, do not improve the significance of the regression.[14]

4.5. Parent price changes at subsidiary earnings announcements: test of Hypothesis 5

Table 6 presents the results of the two-stage regression testing for information transfers when a subsidiary announces before its parent. The first stage regresses subsidiary earnings on subsidiary price changes with the residual, RESID, used as an explanatory variable in the second stage. The second stage regresses parent price changes on the Relative_Size adjusted subsidiary price changes and the residual from the first stage.

The results of the second stage regression show considerable support for information transfers and for our fifth hypothesis. Both of the variables significantly explain parents' price changes at their subsidiaries' earnings announcements. The co-efficient for subsidiary abnormal security returns (β_1) is positive and highly significant ($t = 8.05$, p-value ≤ 0.0001), suggesting that a large part of the parents' returns are related to the returns of their subsidiaries. The coefficient for the portion of subsidiary earnings not explained by the subsidiary return (β_2) is also positive and highly significant ($t = 4.79$, p-value ≤ 0.0001).

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announcement types (parent–subsidiary, first–second) were run. All of these regression results are qualitatively similar to the ones shown in Table 3.

[13] An analysis of the *WSJ* announcements indicates that no separate subsidiary earnings information was released in the parent earnings announcements.

[14] Regressions run with updated subsidiary news as the second announcement (Panel A) and updated parent news as the second announcement (Panel B) obtain results qualitatively similar to the regressions shown in Table 5.

Table 5
The relation between subsidiary abnormal security returns and subsidiary earnings announcements and parent earnings announcements[a]

Panel A: Subsidiary returns around subsidiary earnings announcements

$$CAR\_S_p = \alpha + \beta_1(SNEWS_s) + \beta_2(D2 * SNEWS_s) + e$$

Parameters	*Expected sign*	*Estimates*	*t–statistic*	*P–value*	*Standard error*
Intercept	?	0.0069	2.06	0.0408[b]	0.003
β_1	+	0.3357	3.62	0.0002[c]	0.093
β_2	–	−0.3860	−1.79	0.0375_c	0.216

$n = 235$; $F = 6.583$; p-value $\leqslant 0.0017$; adjusted $R^2 = 0.046$

Panel B: Subsidiary returns around parent earnings announcements

$$CAR\_S_p = \alpha + \beta_1(PNEWS_s) + \beta_2(D1 * PNEWS_s) + e$$

Parameters	*Expected sign*	*Estimates*	*t–statistic*	*P–value*	*Standard error*
Intercept	?	0.0041	1.31	0.1916[b]	0.003
β_1	+	0.2987	1.00	0.1587[c]	0.298
β_2	–	−0.2942	−0.98	0.1652[c]	0.302

$n = 206$; $F = 0.507$; p-value $\leqslant 0.6028$; adjusted $R^2 = 0.00$

[a] CAR_S_s = subsidiary cumulative two-day abnormal security return surrounding its own earnings announcements.
CAR_S_p = subsidiary cumulative two-day abnormal security return surrounding its parent's earnings announcements
$SNEWS_s$ = subsidiary earnings news calculated as the change in subsidiary quarterly earnings per share from one year earlier divided by subsidiary beginning of quarter share price.
$PNEWS_s$ = subsidiary earnings news calculated as the parent earnings change multiplied by the ratio of the market values of the subsidiary to the parent multiplied by the ownership percent all divided by subsidiary beginning of quarter share price.
D1 = a dummy variable equalling one if the parent earnings announcement occurs after the subsidiary announcement and zero otherwise.
D2 = a dummy variable equalling one if the subsidiary earnings announcement occurs after the parent announcement and zero otherwise.
[b] Two-tailed
[c] One-tailed

The sign and significance of β_2 suggests that subsidiary earnings convey significant incremental information above the subsidiaries' abnormal security returns. Finally, the second stage regression is highly significant ($F = 43.871$, p-value ≤ 0.0001) and has an adjusted R^2 of 31%. This implies that 31% of the variance in parent returns when their subsidiaries announce earnings is explained by the combination of subsidiary returns and the incremental information conveyed in subsidiary earnings announcements.

5. Concluding remarks

Accounting researchers have long studied the relation between earnings releases and security prices. No research to date, however, specifically examines the association between earnings announcements and parent and subsidiary valuation. Because subsidiary earnings are part of parent earnings, subsidiary earnings announcements can pre-empt some of the information in subsequent parent earnings announcements. Similarly, parent

Table 6
Two-stage regression investigating the relation between parent abnormal security returns and subsidiary earnings announcements and subsidiary abnormal security returns when the subsidiary announces prior to the parent[a]

First stage: $SNEWS_p = \alpha + \beta_1(Relative\_Size*CAR\_S_s) + RESID$

Parameters	*Expected sign*	*Estimates*	*t−statistic*	*P−value*	*Standard error*
Intercept	?	−0.0121	−2.42	0.0163[b]	0.005
β_1	+	1.3027	13.65	0.0001[c]	0.095

n = 191; F = 186.269; p-value ≤ 0.0001; adjusted $R^2 = 0.49$

Second stage: $CAR\_P_s = \alpha + \beta_1(Relative\_Size*) + \beta_2 RESID + e$

Parameters	*Expected sign*	*Estimates*	*t−statistic*	*P−value*	*Standard error*
Intercept	?	−0.0057	−1.63	0.1056[b]	0.004
β^1	+	0.5416	8.05	0.0001[c]	0.067
β_2	?	0.2458	4.79	0.0001[b]	0.051

n = 191; F = 43.871; p-value ≤ 0.0001; adjusted $R^2 = 0.31$

[a] $SNEWS_p$ = parent earnings news calculated as the change in subsidiary quarterly earnings per share from one year earlier multiplied by the number of subsidiary shares outstanding and the ownership percent and divided by the number of parent shares outstanding and by parent beginning of quarter share price.
CAR_S_s = subsidiary cumulative two-day abnormal security return surrounding its own earnings announcements
Relative_Size = equals the parent's ownership percent multiplied by the ratio of subsidiary market value to parent market value.
RESID = the residual or error term from regressing $SNEWS_p$ on $(Relative\_Size*CAR\_S_s)$.
CAR_P_s = parent cumulative two-day abnormal security return surrounding its subsidiary's earnings announcements

[b] Two-tailed
[c] One-tailed

earnings announcements can pre-empt some of the information conveyed in subsequent subsidiary earnings announcements.

This study, therefore, examines parent price reactions to their own and to their subsidiary's earnings announcements, and subsidiary price reactions to their own and to their parent's earnings announcements. By connecting the affiliated firms' earnings announcements, we provide evidence on (1) the extent that prior announcements affect the informativeness of later earnings announcements and (2) the extent that subsidiary earnings have implications for earnings from parents' non-subsidiary assets.

This study provides an empirical link between parent valuation and subsidiary earnings. For parents with publicly-traded subsidiaries, one source of value-relevant information appears to be the earnings reports of their subsidiaries. Furthermore, our regressions of security price movements against earnings change variables indicate that price changes occur with the first earnings announcement whether it is the parent's or the subsidiary's.

Parent announcements following subsidiary announcements, however, and subsidiary announcements following parent announcements have little information content. This is a result indicative of the effects of sequential information flows on a firm's valuation, consistent with the theoretical model of Holthausen and Verrecchia (1988). As such, our evidence of parent and subsidiary price-earnings relations is generalisable to all sequential information releases.

Subsidiary earnings announcements occurring first appear particularly informative to parent shareholders. This suggests a stronger relation between earnings announcements and abnormal returns than previously found in price-earnings studies. For parents without 100% ownership of their subsidiaries, subsidiary earnings announcements may pre-empt much of the information released in parent earnings reports. Additionally, the information conveyed in subsidiary earnings appears relevant to the valuation of parent's non-subsidiary assets. The information transfer accompanying subsidiary earnings announcements may partially explain the negative relation found in prior studies between firm size and price-earnings relations if larger firms are more likely to have subsidiaries.

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The Japanese Manufacturing Sector in the UK: A Performance Appraisal

Max Munday and Michael J. Peel*

Abstract—Japanese companies represent a particularly dynamic sector of UK manufacturing industry. High levels of Japanese investment, particularly during the mid-1980s, prompted research into many aspects of Japanese operations such as work and management organisation, personnel management and industrial relations practices. Rather less is known about the financial performance of the Japanese sector, with existing studies tending to concentrate on overall sector productivity based on nationally aggregated Census of Production data. Using the FAME corporate accounts database, this paper examines the performance of a sample of Japanese manufacturing subsidiaries in the UK, with reference to a wide range of financial and performance indicators, against a matched sample of domestic firms. This is supplemented by an analysis of the population of domestic, Japanese and other foreign-owned manufacturing firms on the FAME database. While the empirical analysis confirms expectations on comparative Japanese sector performance on labour productivity, domestic firms are found to exhibit superior performance in respect of profitability, asset efficiency, stock efficiency and credit risk. The paper examines the extent to which UK accounts of Japanese subsidiaries are providing an objective view of their performance, and concludes that Japanese firms may be engaged in transfer-pricing strategies which have the effect of minimising liability to UK corporation tax. The policy implications of these findings are examined.

1. Introduction

The growth of Japanese manufacturing foreign direct investment (FDI) in the UK economy has been relatively rapid, rising from only 17 enterprises employing 3,000 in 1981 to 117 enterprises employing 58,000 people in 1992, accounting for £6.1bn of sales and just over £2.5bn of net output in 1992 (Business Monitor, 1995a). These totals have steadily increased in the period to 1996, with Japanese manufacturers now estimated to account for over 10% of both UK foreign manufacturing sales and output. Japanese manufacturing FDI has also grown in terms of diversity. Initial investments in the 1970s and early 1980s, by firms such as Sony, Hitachi, Sharp, and Mitsubishi, were concentrated in the consumer electronics sector. However, by 1993 the net value of Japanese manufacturing assets in the UK (£1.3bn) was evenly divided between electrical engineering (35%), transport equipment (33%), and mechanical engineering/other manufacturing (32%). This more even distribution reflected the substantial investments made by Japanese motor vehicle manufacturers in the period after 1984 (Business Monitor, 1995b). The late eighties also saw other changes in the composition of Japanese FDI, with greater diversification in entry mode (i.e. a greater number of joint ventures and acquisitions in addition to greenfield ventures), and with increasing numbers of 'second wave' automobile and electronics component manufacturers entering the UK to support existing Japanese operations, and to seek new market opportunities.

Studies of Japanese manufacturing subsidiaries' operations in the UK have focused on personnel management, work organisation and industrial relations practices (see, for example, Oliver and Wilkinson, 1992). A smaller number of studies have examined the cost and management accounting practices within Japanese subsidiaries in the UK (Yoshikawa et al., 1989; Bromwich and Inoue, 1994; Carr and Ng, 1995). In addition, there have also been studies of the economic impact of Japanese FDI in the UK. For example, previous research has examined the spatial distribution of Japanese investment in the UK (Taylor, 1993), trends in subsidiary growth (Morris et al., 1993), and the impact of increased competition from Japanese subsidiaries on domestic firms (Dunning, 1986; Brech and Sharp, 1984; Strange, 1993). Studies have also investigated the contribution of Japanese FDI to both regional and national development—for example, in terms of job creation, skills development and technology transfer (Dillow, 1989; Munday et al., 1995; Morris, 1988; Strange, 1993; Trevor, 1985).

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*The authors are, respectively, lecturer in business economics and distinguished senior research fellow in accounting and finance at the Cardiff Business School, University of Wales, Cardiff. We are particularly grateful to two anonymous referees for their detailed comments on earlier drafts. Correspondence should be addressed, to either author, to Cardiff Business School, Colum Drive, Cardiff, CF1 3EU. This paper was first submitted in November 1996 and finally accepted in August 1997.

Research on the relative performance of Japanese enterprises in the UK has proceeded in several directions. A number of studies have examined the general productivity of Japanese plants in the UK in comparison to plants located in Japan (Dunning, 1986; Strange, 1993). A further line of research has investigated the financial characteristics and marketing performance of Japanese subsidiaries located in the UK. For example, using UK cross-sectional data, Doyle et al. (1992) examined the characteristics of matched samples of 90 US, Japanese and indigenous subsidiaries in the consumer goods, industrial goods and financial services sectors. Primary data for the study were drawn from interviews with senior managers. These interviews indicated that, relative to Japanese subsidiaries, the managers of US and UK subsidiaries were more likely to be 'short termist' by reference to their stated preference for 'quick profits' over 'consolidation' of market share. However, the managers of Japanese subsidiaries rated market performance (market share) as being a significantly more important corporate objective than their UK and US counterparts.

Doyle et al. also reported that the increased commitment of Japanese firms to long-term performance objectives created greater support and confidence in employees within their subsidiaries. The managers of UK and US firms tended to view cost-cutting as a means of improving productivity, whereas Japanese managers perceived increases in market share as a key strategy to reduce costs and increase productivity. Further evidence of the commitment of Japanese firms in the UK to longer-term strategic objectives comes from the research of Bromwich and Inoue (1994), who in a 1991 interview survey of Japanese subsidiary managing/finance directors reported that the most important strategic objectives in their sample firms were return on sales and increasing market share. The study also reported that in terms of the achievement of stated objectives, the interviewed managers were most satisfied with their sales growth, and least satisfied with earnings growth and return on investment. On a similar theme, a more recent KPMG (1996) survey of the managers of 70 of the 'top' Japanese manufacturing subsidiaries operating in the UK reported that 53% of respondents considered their subsidiary was characterised by 'low' profitability, with none considering their company's profitability to be 'high'.

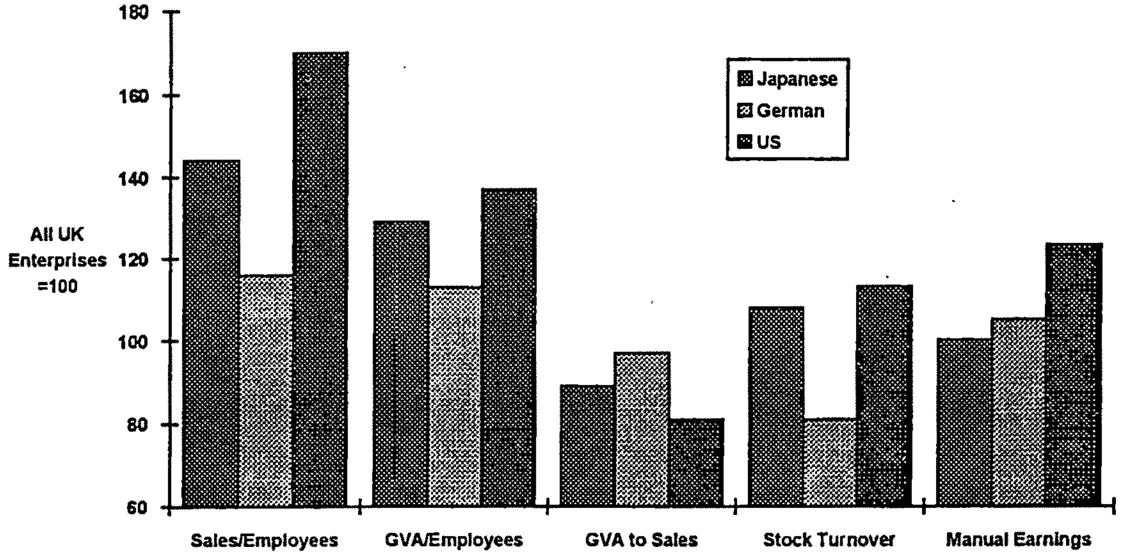
The comparative performance of Japanese subsidiaries has also been examined at the national (macro) and regional levels. Figure 1 reports some of the typical Census of Production data on the performance of foreign-owned subsidiaries in the UK. It shows that Japanese subsidiaries (compared to all UK manufacturing enterprises) perform relatively well on productivity measures, such as gross value added per employee, sales per employee and stock turnover. On measures of gross value added to sales, Japanese subsidiaries tend to perform at a similar level to other foreign subsidiaries. Typically, however, manual earnings in Japanese subsidiaries are lower than those in German and US subsidiaries, yet still higher than the overall national average.

Census data have also been used to both support and refute the 'warehouse' thesis of Japanese manufacturing investment—that is, the hypothesis that Japanese manufacturing in the UK is characterised by routine production operations, as evidenced by comparatively low earnings and low value added per employee (see Haslam et al., 1995; Munday et al., 1995; Williams et al., 1992). However, Census data should be treated with caution, since observed differences (e.g. in labour productivity) may be associated with industrial sector and corporate size variations. For example, a study by Davies and Lyons (1991), which examined the productivity (gross value added per employee) of foreign-owned and domestic firms (using data derived from the 1986 UK Census of Production), found that, although foreign-owned manufacturing firms exhibited a 40% productivity advantage over domestic firms, only 50% of this advantage was attributable to ownership differences. The remainder was due to structural effects, with foreign manufacturing being more heavily represented in capital intensive sectors which, ceteris paribus, are characterised by higher labour productivity.

In addition to the direct grants and subsidies expended to attract FDI, funds to market the UK and its regions to inward investors have also become increasingly scarce, and are associated with high opportunity costs in terms of indigenous sector development. Despite these concerns, Japanese manufacturing investment (and indeed all FDI) is viewed by the Department of Trade and Industry as a means of improving UK domestic manufacturing corporate performance. Policy sentiments are summed up by Eltis and Fraser (1992), who noted that:

> 'The presence of some of the best Japanese companies in an industry creates a clear challenge to remove known inefficiencies. In Britain these pressures have stimulated managements to raise productivity sharply, to eliminate overmanning, and to cease to tolerate low quality...Britain is therefore finding that the ideal way to remedy industrial weaknesses is to get the world's best into the economy, and to learn from them with the greatest possible rapidity.'

Figure 1
Relative performance of foreign-owned subsidiaries (All UK Enterprises = 100)



Source: Census of Production, 1992

The extent to which UK industry has been influenced by a process of 'Japanisation', and its desirability, has also been the subject of extensive research and academic debate (see Oliver and Wilkinson, 1992). In this context, Trevor and Christie (1988) reported that Japanese FDI had stimulated changes in the work and management practices of domestic firms. They concluded that:

> 'In many ways the inward [Japanese] investors seem to have acted as a catalyst for British manufacturers, and have been at least partly instrumental in forcing the pace on the implementation of quality improvement programmes, single status arrangements, JIT delivery, improved internal communications and so on.'

However, Haslam et al. (1995), and Williams et al. (1992), question the premise that UK enterprises will inevitably benefit from the local presence of Japanese manufacturing capital. They demonstrate that the strategic and political rationale (i.e. import replacement) underlying Japanese investments in the West places a limit on the scope of local subsidiary operations, and argue that Japanese manufacturing plants will be constrained to largely production-only operations characterised by comparatively low value-added performance measures.

In summary, a number of research approaches have been used to examine the performances of foreign-owned firms in the UK: macro-level and regional studies, comparisons at the firm level, and micro (plant level) studies using primary data drawn from questionnaires and/or case studies. Each approach has its relative advantages and disadvantages, but all are seeking to examine whether foreign direct investment has had an impact on regional and national development, in terms of domestic corporate performance, employment, output, exports, manufacturing technology, work and labour practices, and management techniques.

This paper extends previous research, by examining the comparative performance of Japanese manufacturing subsidiaries with reference to a much wider range of financial and performance indicators than has been used in previous studies. The research focuses on matched samples of 97 Japanese and domestic manufacturing subsidiaries drawn from the FAME CD-Rom accounts corporate database. The performance of these subsidiaries is evaluated with reference to variables relating to employment, remuneration, profitability, labour and asset productivity, stock efficiency, liquidity, gearing and credit risk. The matched sample analysis is also supplemented by an examination of the characteristics of the population of Japanese, other foreign-owned and British manufacturing firms on the FAME database. In addition, the paper provides some new evidence on the issue of transfer pricing and Japanese firms.

The next section of the paper describes the study's data, variables and methodology. This is followed by the empirical findings. The final section explores the ramifications of the study for

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public policy, and includes suggestions for further work.

2. Data and method

The firm-specific data used in this study are drawn from the FAME CD-Rom database (produced by Jordans). The database contains annual financial and non-financial information on over 190,000 British companies,[1] largely drawn from annual company reports and accounts. In September 1995, a total of 711 Japanese subsidiaries (that is, where the controlling interest resides in a Japanese parent company) were available for analysis. Of these, 193 (29.1%) were listed (under standard industrial classification [SIC 1980] codes 2, 3 and 4) as having their primary activities classified in manufacturing (i.e. where the company had stated in its annual report that its primary/predominant business activity was manufacturing). This sample was subsequently reduced to 104 firms for the following reasons. First, small and medium-sized companies, under the 1985 Companies Act, may file abbreviated accounts that exclude sales. In total, 64 Japanese subsidiaries had no sales data (a matching criterion) and were therefore excluded. An additional 23 subsidiaries were found to be subsidiaries of other Japanese firms in the sample, and in consequence were also excluded. Finally, two subsidiaries that had failed were also excluded.

The sales figure and three digit SIC code for each of the remaining 104 Japanese subsidiaries were then collected to facilitate matching to domestic firms.[2] A majority of the Japanese subsidiaries had data available for their financial year ending in 1994, but in 21 cases data were only available for 1993. An iterative search procedure was then conducted on the basis of three digit SIC code, subsidiary status and sales revenue to match each Japanese subsidiary to a domestic one on the basis of sales, primary SIC code and year (1993 or 1994) of data. Exact matching on the basis of sales proved difficult, hence matching was conducted on the basis of a sales range of plus or minus 5%. Of the 104 Japanese firms, it was possible to match 97 to domestic subsidiaries on the selected criteria. The sectoral distribution of the Japanese and matched domestic subsidiaries is shown in Figure 2.

As noted above, and following previous work which has stressed the importance of size and industry variations (Davies and Lyons, 1991; Oyelere and Emmanuel, 1996), a matched sample research design was used to avoid the bias which might otherwise be introduced from corporate size, subsidiary/independent status and industry differences. Compared with previous cross-sectional corporate studies, a wide range of performance variables (24) were collected from each corporate record, focusing on both labour and asset productivity, profitability, stock efficiency, liquidity, gearing and credit risk. However, it should be noted that some firms had missing values for the variables described below. In large measure this situation arises because some smaller subsidiaries filed modified accounts. In all cases, where a firm in one sample had a missing value for a variable, its matched counterpart was also assigned a missing value. This procedure ensured that, for all variables, each Japanese subsidiary is matched to a domestic firm. The analysis which follows, therefore, is based on equal-sized matched samples for all the variables reported. Full definitions of each variable are provided in the Appendix.

A number of hypotheses are relevant here. The government policy of aid (now largely restricted to Regional Selective Assistance under the 1972 Industry Act) to investors in UK regions initially presupposes that new investment provides both direct jobs and indirect employment through enhanced trading opportunities for other firms. Indeed, the jobs 'additionality' of foreign manufacturing investment is a key criterion for policy evaluations (see National Audit Office, 1991). Furthermore, there is an expectation that newly-created jobs are of long-term duration and are of good quality in terms of earnings. In addition, while not part of the official quantitative evaluation of UK foreign manufacturing activity, it is also argued that domestic firms will benefit from knowledge spillovers flowing from the adoption of the hybrid methods of production, personnel management and work organisation found in Japanese subsidiaries—thus improving the competitiveness of domestic firms (see Trevor and Christie, 1988; Eltis and Fraser, 1992).

As noted above, while the UK Census of Production makes no allowances for structural firm-specific differences between Japanese and UK manufacturing companies, it does provide some indication of the relative characteristics of the Japanese and domestic sectors at the macro level. For example, Figure 3 demonstrates how Japanese subsidiaries outperformed UK-owned manufac-

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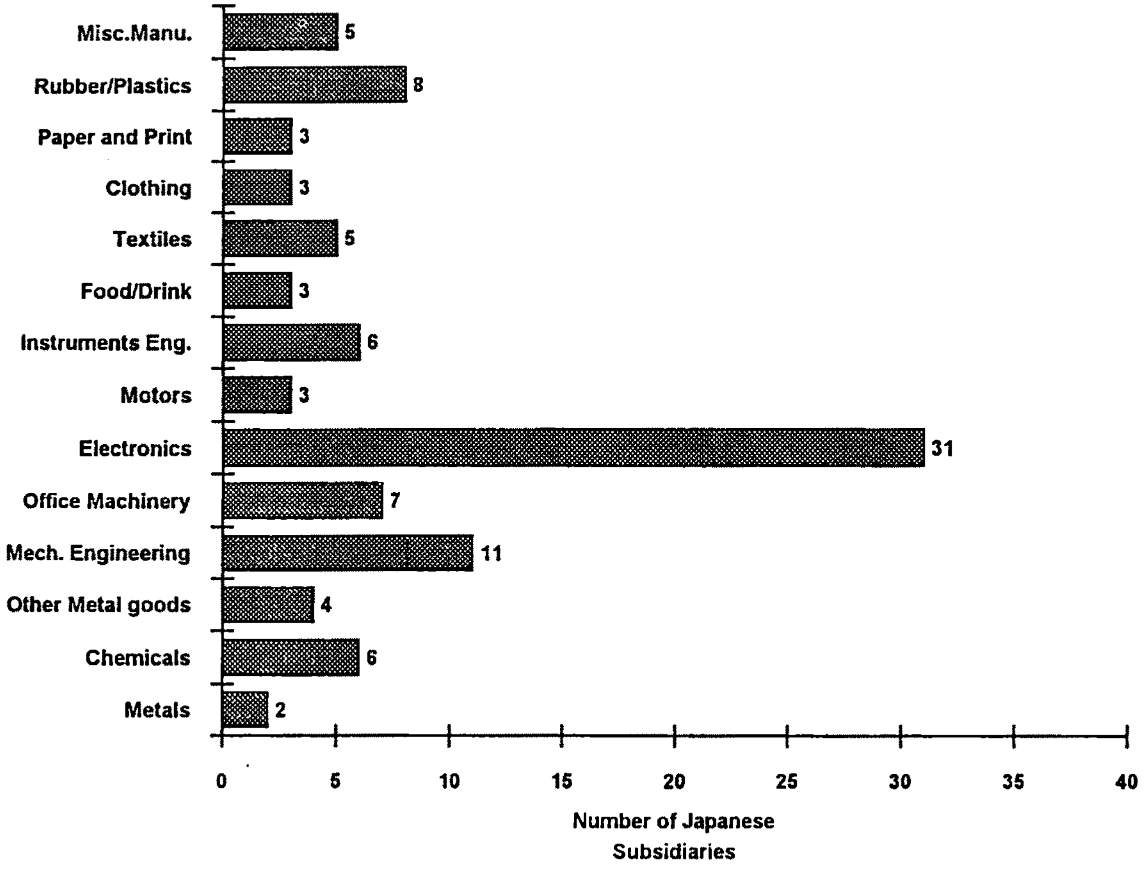
[1] All British firms meeting at least one of the following criteria are included on the database: (i) a turnover of £0.5m or more; (ii) shareholder funds of £250,000 or more; and (iii) pre-tax profits of £50,000 or more. In addition, the database contains a substantial number of smaller firms which have 'featured' in previous Jordan surveys. For example, in 1996 the database contained 25,061 firms with turnover below £0.5m.

[2] Companies in the second sub-sample were not matched by age (date of incorporation). However, as noted by a referee, this could be an important variable if Japanese subsidiaries pursue a policy of market penetration in their early years of operation. This would be one possible area for future research, particularly as an interview study by Doyle et al. (1992) has reported that Japanese subsidiary managers in the UK rated market share increases as more important than profits, compared with their UK and US counterparts.

Figure 2
Sectorial profile of sampled firms (n = 97)



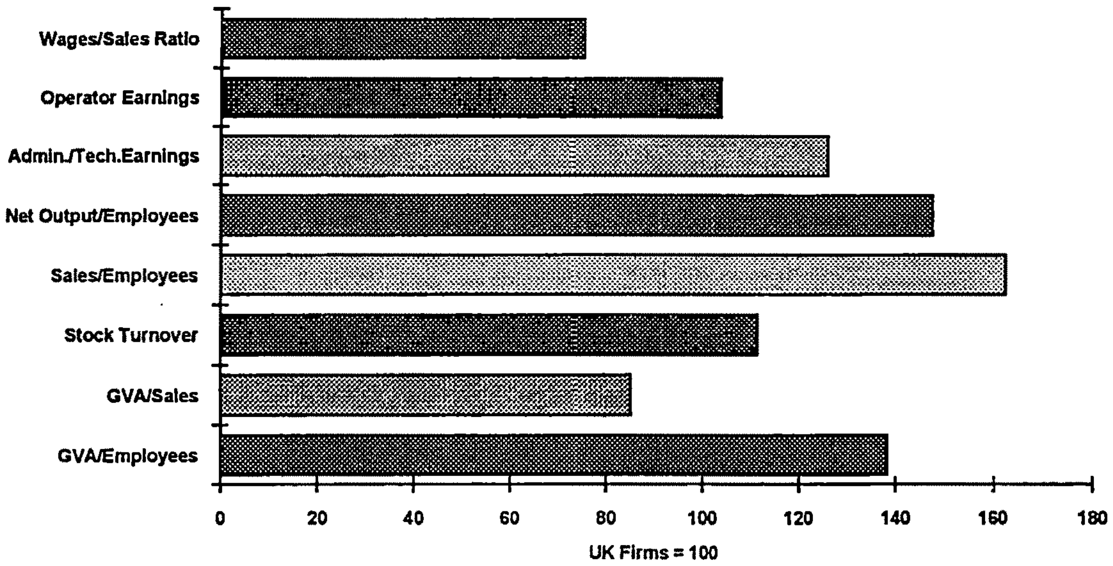
turing firms in 1992 with reference to sales per employee, gross value added per employee, net output per employee and stock turnover. Figure 3 also shows that, in aggregate, Japanese manufacturing firms exhibited lower gross value added to sales than their domestic counterparts, possibly because of the higher proportion of goods bought in by Japanese subsidiaries (Munday et al., 1995). The relatively high stock turnover ratios of Japanese subsidiaries are often attributed to the utilisation of superior stock management techniques, including JIT and Kanban. For example, in the UK, Oliver and Wilkinson (1992) reported that 87% of their sample of Japanese subsidiaries considered that the implementation of JIT and Kanban systems had been successful or highly successful.

Figure 3 also shows that Japanese manufacturing companies generally pay their employees more than their counterparts across both operative and clerical/technical grades, but that the ratio of total wage bill to sales is lower than in domestic firms. On liquidity and solvency indicators, there is also some prior expectation that Japanese subsidiaries will perform comparatively well. The systems of accelerated materials flows emerging in established Japanese plants require the careful management and monitoring of assets including cash, debtors and stock. For example, it has been reported that Japanese firms manage their cash relatively efficiently, and tend to be particularly prompt payers of suppliers and subcontractors (Munday, 1990).

Variables 1–6 in the appendix focus on size, employment and remuneration characteristics. These are annual turnover (TURN), total assets (TASS), fixed assets (FASS), number of employees (EMP), total annual wage bill (TOTREM), and average annual employee pay (AVREM). An additional 11 variables (variables 7 to 17 in the appendix) cover corporate performance and efficiency characteristics, including sales per employee (SALEM), wage bill (expense) to sales (REMS), net profit per employee (NPEM) and gross trading profit per employee (GPEM).

Four variables focus on corporate profitability: net profit margin (NPMG), gross trading profit margin (GPMG), return on capital employed (RETCE), and a binary variable (LOSS), which indicates whether or not a company is loss-making (on the basis of net profit before taxation). The

Figure 3
Relative performance of Japanese subsidiaries in 1992 (UK-owned manufacturing firms = 100)



Source: Census of Production, 1992

ratio of sales to total assets (TUTA) and sales to fixed assets (TUFA) are two standard variables (see, for example, Van Horne, 1987), which measure how efficiently a company utilised its assets to generate revenue. Stock efficiency is measured with reference to average days' stocks held (DAYST), which is the ratio of stock to sales expressed in days—that is, the number of days sales represented by current stock holdings.

The appendix also contains seven variables (18–24) which relate to corporate liquidity, gearing and financial risk characteristics. The first two (DAYD, DAYC), are ratios that focus on relative cash flow in terms of outstanding debtors (cash owed from customers) and creditors (cash owed to suppliers). Two standard ratios were collected to examine solvency and liquidity characteristics. The first variable (CURA) is the current ratio (current assets to current liabilities). However, current assets include the least liquid of assets (stock). In consequence, a second solvency variable (QRAT) is employed, which is the ratio of current assets less stock to current liabilities.

Variables 22–24 in the appendix cover financial and credit risk. A standard gearing ratio (TLTA) is included in the analysis. This is the ratio of total liabilities to total assets. A second variable focuses on financial risk with reference to interest cover (ICOV), defined as the ratio of net profit before interest and tax to interest paid. The final variable (CRISK) is the credit risk score assigned to each company by FAME, via an independent credit risk assessment agency (Qui Credit Assessment Ltd).

The credit rating allocated to each company is on a scale varying between 0 (highest risk) to 100 (lowest risk). Credit risk is segmented into five bands (by Qui Credit) ranging from 'high risk' (0-20) to 'secure' (81-100). In relation to a high-risk rating, the FAME manual states that 'companies in the high risk sector are unlikely to be able to continue trading unless significant remedial action is undertaken, there is support from a parent company, or specific circumstances apply'.

3. Empirical results

3.1. Matched sample analysis

In the following descriptive analysis, the Japanese and domestic sub-samples are compared on a matched basis. Hence, as noted above, each Japanese subsidiary is matched to a domestic one on the basis of primary manufacturing (SIC code), corporate size (sales), and year (1993/94) of data. The performance of the two sub-samples is assessed by reference to the mean (with standard deviations shown in parenthesis) and median values of the variables previously described. Parametric student t-tests were conducted to identify any significant differences between variable means. However, because it is known that some financial ratios (e.g. ICOV) may exhibit non-normal distributions (see, for example, Ezzamel and Mar-Molinero, 1990), non-parametric (chi-square) differences between median tests are also reported (see Siegel and Castellan, 1988).

3.1.1. Size, employment and remuneration characteristics

Table 1 shows that the mean and median sales values (TURN) of the Japanese and domestic sub-samples do not differ significantly and therefore tend to confirm the general accuracy of the matching procedure described above. Table 1 also shows that the mean values of fixed (FASS) and total (TASS) assets do not differ significantly, although there is some evidence (at the 10% level) that the median value of FASS is significantly higher in the Japanese sub-sample. However, on average, Japanese subsidiaries employ significantly fewer people (405) than their domestic counterparts (672), with the average Japanese workforce amounting to only 60% of that of the domestic firms. Clearly, at least part of this difference may be attributable to differing levels of capital intensity (although the mean value of fixed assets in the domestic and Japanese sub-samples are not significantly different).

There has been some criticism of the low earnings levels within Japanese plants, with concern at the regional level focusing on the perceived high proportion of semi-skilled female labour employed on production lines (Morris, 1988). However, Table 1 reveals that, on average, Japanese firms paid their employees significantly more (£18,563) than their domestic counterparts (£16,246). Given that Table 1 shows that the total wage bill (TOTREM) of the Japanese firms is, on average, substantially lower (£6.92m) than in matched domestic firms (£11.31m), this result is particularly illuminating: on average, Japanese subsidiaries, generating similar turnover to domestic subsidiaries (and involved in similar manufacturing activities), employing significantly fewer employees, exhibit a significantly lower wage bill expense, but pay their employees significantly more.

3.1.2. Performance and efficiency characteristics

Given the findings discussed above, it is perhaps unsurprising that Table 2 reveals that, on average, Japanese firms generate significantly more turnover per employee (SALEM) than matched domestic firms[3], with both the mean (£126,718) and median (£89,424) values of SALEM being substantially and significantly higher in the Japanese sample than in the matched domestic sample (£67,727 and £56,957 respectively). Consistent with the previous results, Table 2 also shows that the wage bill to sales ratio (REMS) is significantly

Table 1
Size, employment and remuneration characteristics

	Japanese		*Domestic*		*Significance tests*	
Variables	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[2]**	**Median[3]**
TURN	43278.4 (66287.3)	15268.0 (n=97)	42433.7 (63603.1)	15523.0 (n=97)	0.09 (0.928)	0.00 (1.00)
TASS	32082.7 (43595.8)	13628.5 (n=96)	32640.6 (55507.9)	10195.5 (n=96)	0.08 (0.938)	1.02 (0.312)
FASS	12218.2 (19641.4)	3895.5* (n=96)	11084.2 (23599.2)	2762.5* (n=96)	0.36 (0.718)	3.52 (0.061)
EMPL	404.9** (593.1)	195.0 (n=87)	671.6** (931.5)	243.0 (n=87)	2.25 (0.026)	0.823 (0.630)
TOTREM	6923.4** (10439.8)	3018.0 (n=92)	11309.8** (16486.9)	3315.5 (n=92)	2.16 (0.033)	0.827 (0.363)
AVREM	18,562.9** (7,718.2)	17,495.4 (n=87)	16,245.9** (4,627.8)	15,491.8 (n=87)	2.40 (0.018)	0.02 (0.882)

[1] Means are unbracketed, with associated standard deviations shown in parenthesis.
[2] T-values are unbracketed, with associated probabilities shown in parenthesis.
[3] Chi-square values are unbracketed with associated probabilities shown in parenthesis.
**,*Indicates mean and median values are significantly different at the 5% and 10% levels respectively.
(Student's t-tests for means and chi-square tests for medians.)

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[3] As noted by a referee, higher sales per employee does not (strictly speaking) imply higher labour productivity. A more refined measure would be gross value added per employee (which is not available on FAME). We do, however, report gross profit per employee (GPEM) and net profit per employee (NPEM) ratios.

lower in the Japanese sample, with Japanese firms exhibiting a mean ratio (21.8%) some six percentage points lower than that of their matched domestic counterparts (27.8%). Despite this, Table 2 shows that domestic firms exhibit higher mean and median NPEM (net profit per employee) ratios than their matched Japanese counterparts.[4] This position is reversed for trading profit (sales minus manufacturing cost) per employee (GPEM), but neither the mean nor median GPEM ratios differ significantly between the two samples (note that Japanese firms employ fewer people than the matched domestic firms).

The results in Table 2 on the relative profitability of the two samples, however, throw some light on the preceding analysis. They show that the mean net profit margin (NPMG) of the Japanese firms is negative (−1.89%) and significantly lower than for matched domestic firms (6.73%). Table 2 also reveals that no less than 46.4% of Japanese firms were making a loss (by reference to net profit before tax) compared with only 19.6% of domestic firms (chi-square test significant at $p=0.000$). These results are also confirmed by reference to the widely used return on capital employed (RETCE) ratio, with Japanese firms displaying negative mean returns (−0.26%) which are substantially and significantly lower[5] than the average return on capital employed generated in the domestic sample (10.77%). Consistent with these results, Table 2 reveals that the mean gross (trading) profit margin (GPMG) of domestic firms (30.1%) is also significantly higher than that of Japanese firms (23.5%).

Overall, this analysis demonstrates that the Japanese firms are significantly less profitable than their matched domestic counterparts with reference to a range of profitability attributes—a finding which is discussed in more detail below in relation to transfer pricing issues.

The final three variables reported in Table 2 focus on asset (TUTA, TUFA) and stock (DAYST) efficiency, with domestic firms out-performing their matched Japanese counterparts by reference to all these ratios. Hence domestic firms exhibit significantly higher mean assets turnover ratios (TUTA = 1.66 and TUFA = 9.33) than their Japanese counterparts (1.43 and 7.46), which suggests that domestic firms, perhaps surprisingly, utilise their assets more efficiently in terms of revenue generation. Table 2 shows that by reference to stock holdings (DAYST), Japanese firms held an average of 77 days of stock, which is significantly higher than for the matched domestic subsidiaries (51 days). Bromwich and Inoue (1994) also highlight in their interview study (above) the high level of inventories being held by Japanese subsidiaries in 1991. This is a particularly important finding in that, to the extent the Japanese subsidiaries may be expected to emulate Japanese production techniques (e.g. JIT), Japanese firms may have been expected to hold less stock (Oliver and Wilkinson, 1992). It is also noted that the stock turnover performance measures for Japanese firms at the macro level (Figure 3) appear to give a misleading view. When differences in industry and size are taken into account, domestic subsidiaries actually significantly outperform their Japanese counterparts.

Finally, Table 3 reports a correlation matrix for the performance and efficiency variables, and shows that higher stock holdings (DAYST) is negatively and significantly correlated with both profitability (NPEM, NPMG, RETCE) and efficiency variables (TUTA, TUFA). A higher wage bill to sales ratio (REMS) is also negatively associated with profitability and efficiency variables (SALEM, GPEM, NPMG, TUTA), but higher turnover per employee (SALEM) is positively and significantly associated with higher gross profit per employee (GPEM), and higher asset turnover (TUTA). As expected, Table 3 also shows that the profitability variables are all positively correlated—with particularly strong correlations between RETCE and NPEM, NPEM and NPMG and NPMG and RETCE.

3.1.3. Japanese subsidiaries' profits and transfer pricing

The poor comparative profitability of the Japanese subsidiaries clearly requires further analysis. There are a number of issues. As noted above, Doyle et al. (1992) reported that the managers of Japanese subsidiaries operating in the UK appeared to give a lower priority to short-term profit maximisation, but rather focused on increasing market share—a finding receiving some support from the evidence provided by the current study. It is also possible that the results support the hy-

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[4] The reason why, in the Japanese sub-sample, the mean net profit margin (NPMG) is negative, but the net profit per employee (NPEM) is positive, is because of the variance in size of the different denominators (sales and employees respectively). For example, the mean value of NPMG for the 87 Japanese firms which had data available was −1.53% (compared with a mean NPEM of £1,613 for the same 87 firms).

[5] As noted by a referee, domestic firms are more labour intensive than Japanese ones, which may influence RETCE variation. However, the total wage bill expense (TOTREM, REMS) is significantly lower in Japanese firms and should, ceteris paribus, therefore result in higher mean profits in the matched Japanese sub-sample. Japanese firms also exhibit significantly higher capital to labour cost ratios (FAREM, defined as fixed assets/total wage bill) than domestic firms—with the mean FAREM ratio for Japanese firms at 1.92 being more than double that (0.814) of domestic firms (t-value for mean difference = 5.19, $p=0.000$, $n=182$). However, FAREM is negatively, but insignificantly, correlated with RETCE ($r=-0.108$, $p=0.144$, $n=182$). There is no evidence, therefore, that more capital intensive firms are associated with a higher return on capital employed.

Table 2
Performance and efficiency characteristics

	Japanese		*Domestic*		*Significance tests*	
Variables	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[2]**	**Median[3]**
SALEM	126,718.3*** (130,631.4)	89,424.5*** (n=87)	67,727.2*** (38,838.8)	56,957.1*** (n=87)	4.04 (0.000)	9.20 (0.002)
REMS	21.84*** (12.21)	19.96*** (n=92)	27.79*** (9.45)	27.82*** (n=92)	3.70 (0.000)	6.28 (0.011)
NPEM	1,613.1 (20,254.8)	542.9*** (n=87)	4,789.7 (7,847.3)	3,414.5*** (n=87)	1.36 (0.175)	15.54 (0.000)
GPEM	25,200.3 (26,938.7)	19,054.3 (n=62)	21,478.1 (16,666.9)	16,157.4 (n=62)	0.92 (0.358)	0.291 (0.590)
NPMG	−1.89*** (20.11)	0.25*** (n=97)	6.73*** (8.72)	6.12*** (n=97)	3.87 (0.000)	18.55 (0.000)
LOSS	46.4† (N/A)	N/A (n=97)	19.6† (N/A)	N/A (n=97)	N/A	N/A
GPMG	23.46** (17.35)	20.84*** (n=72)	30.05** (15.65)	28.71*** (n=72)	2.39 (0.018)	6.25 (0.012)
RETCE	−0.26*** (21.49)	0.33*** (n=96)	10.77*** (13.27)	10.59*** (n=96)	4.28 (0.000)	25.52 (0.000)
TUTA	1.43* (0.82)	1.33*** (n=96)	1.61* (0.59)	1.51*** (n=96)	1.75 (0.081)	9.18 (0.002)
TUFA	7.46* (9.65)	4.51 (n=96)	9.33* (10.22)	6.57 (n=96)	1.72 (0.087)	1.69 (0.193)
DAYST	77.51*** (70.55)	58.23*** (n=95)	51.19*** (33.32)	46.77*** (n=95)	3.29 (0.001)	6.82 (0.009)

[1] Means are unbracketed with associated standard deviations shown in parenthesis.
[2] T-values are unbracketed with associated probabilities shown in parenthesis.
[3] Chi-square values are unbracketed with associated probabilities shown in parenthesis.
***,**,*Indicates means and median values are significantly different at the 1%, 5% and 10% levels respectively. (Student's t-tests for means and chi-square tests for medians.)
†Indicates sample proportions are significantly different at the 1% significance level (chi-square = 15.76; p = 0.000). N/A = not applicable

Table 3
Correlation matrix (performance variables)

	REMS	*SALEM*	*NPEM*	*GPEM*	*NPMG*	*GPMG*	*RETCE*	*TUTA*	*TUFA*
SALEM	−0.675**								
NPEM	−0.163	0.036							
GPEM	−0.345**	0.658**	0.247**						
NPMG	−0.249**	0.027	0.898**	0.147					
GPMG	−0.299**	−0.146	0.193*	0.518**	0.090				
RETCE	−0.041	−0.047	0.847**	0.155	0.875**	0.238**			
TUTA	−0.201*	0.203*	0.153	−0.039	0.220*	−0.169	0.203**		
TUFA	0.023	0.067	0.152	0.107	0.181*	0.112	0.242**	0.496**	
DAYST	0.050	−0.009	−0.430**	−0.096	−0.334**	−0.099	−0.231**	−0.408**	−0.261**

**,* Indicates correlation coefficients are significant at the 1% and 5% levels respectively (two-tailed tests).

potheses that Japanese subsidiaries (or at least some of them) were indulging in transfer pricing policies to minimise UK corporate tax liability. This is certainly a popularly-held belief, at least by the press (see Buckley and Hughes, 1997). For example, it has been estimated (Piper, 1996) that multinational corporate tax evasion is costing the Exchequer as much as £1.5bn a year. More specifically, Piper reported that UK-based operations controlled by the Japanese electronics giants Mitsubishi, Brother and Sharp operated at a cumulative loss (net profit before tax) throughout the period 1984–1994.

There are a number of ways of manipulating inter-firm transfers, but one corollary of this profitability analysis is that expenses, other than the wage bill (as discussed above), are being substantially overstated. To investigate this issue in more detail, the combined total taxable profits (net profit before tax) of the two sub-samples were calculated. The results of this exercise are particularly revealing, in that the total taxable profits of the Japanese sample (n = 97) amounted to only £2.293m (mean = £23,639), which is in stark contrast to the total taxable profits of the matched domestic sample (n = 97), which is approaching 98 times higher at £224.04m (mean = £2.31m). At the very least these results suggest that, in relative terms, Japanese firms pay minimal corporation tax to the Exchequer.

Additional analysis on those Japanese (n = 72) and matched domestic firms (n = 72) which disclosed gross trading profits, revealed that the difference between the mean gross profit margins (GPMG) of the Japanese (23.46%) and matched domestic firms (30.05%) is 6.59 percentage points. For the same companies, the difference between the net profit margins (NPMG) of the Japanese (−2.70%) and domestic firms (6.26%) is 8.96 percentage points—that is, the gross profit differential (6.59%) increases by only 2.37 percentage points with reference to NPMG. This demonstrates that it is the Japanese firms' relatively large manufacturing expenses (cost of goods sold)—rather than the period costs (such as selling and distribution and administration expenses)—that are largely responsible for their comparatively poor profitability.[6]

Given that Japanese firms have a significantly lower mean wage bill to sales (REMS) expense ratio, this additional analysis suggests it is high input prices (i.e. raw materials, components and semi-finished goods, etc.) that are associated with the relatively low profitability of Japanese subsidiaries—a finding which, prima facie, is consistent with potential transfer pricing to avoid taxation or to minimise exchange rate risks (below). However, to the extent that Japanese subsidiaries in the UK trade with local suppliers/domestic firms, then the opportunities for transfer pricing could be reduced. In this context, the extant literature (JETRO, 1996; Munday et al., 1995) suggests that, in addition to domestic suppliers, Japanese subsidiaries located in both the UK and Europe are supplied from a variety of sources, including Japanese parent companies, related group companies in Japan and the Far East, together with other subsidiaries of the Japanese parent.

Clearly, however, caution must be applied in reaching the above conclusions on transfer pricing. First, the analyses focus on just one year of financial data for each sampled company in one geographical area. There is a need to consider whether any special circumstances applied to Japanese subsidiaries in the 1993–1994 period which may have adversely affected profits, and whether the poor comparative profit performance of Japanese firms was replicated in other key global locations during the period. Having established conclusions here, there is also a need to consider whether poor comparative profitability is a characteristic of Japanese subsidiaries in other time periods. Finally, there is a need to examine the motives for transfer pricing among Japanese subsidiaries in the UK, particularly when, in 1994, the UK was characterised by relatively low corporate tax rates in the global economy, which would prima facie indicate that more profits would be declared here (see Emmanuel and Mehafdi, 1994: 72).

In terms of the comparative profitability of Japanese manufacturing subsidiaries, several reports have demonstrated that the European Union is one of the least profitable global locations for Japanese manufacturing enterprises. For example, the Japanese Ministry of International Trade and Industry (MITI, 1996), in a survey of Japanese overseas operations, found that mean after-tax return on sales of Japanese subsidiaries (in manufacturing and services) in the ASEAN (Association of South East Asian Nations) states, the US and the European Union over the period 1991 to 1993 were 2.4%, −0.5% and −1.8% respectively. After-tax losses of Japanese subsidiaries in the EU averaged $76bn a year between 1991 and 1993. Poor Japanese subsidiary performance in Europe in this period was thought to be at least partially linked to problems experienced by parent firms and the Japanese domestic economy. The Japanese 'bub-

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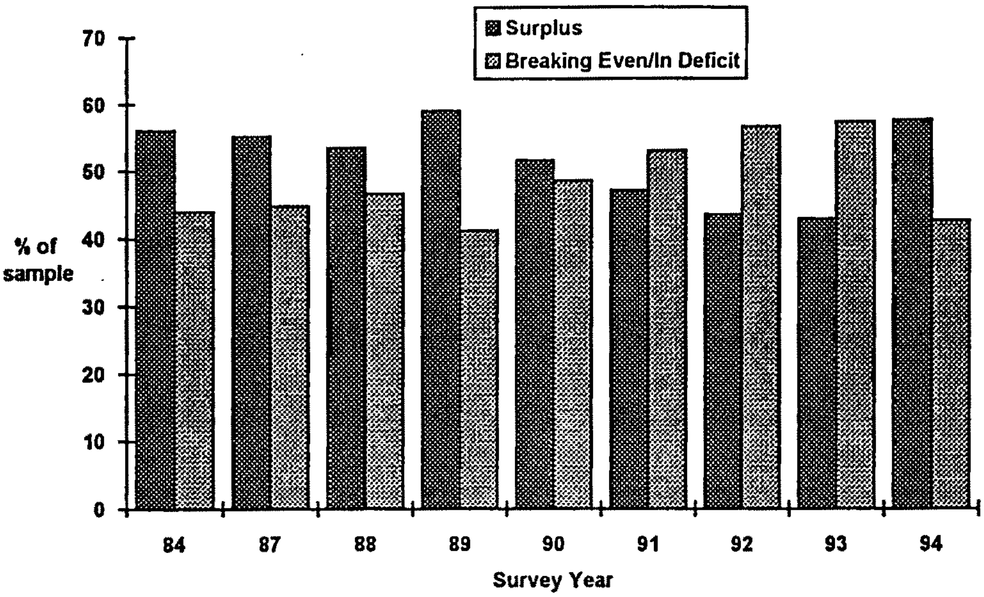
[6] This was confirmed when total expenses (manufacturing plus non-manufacturing expenses) as a percentage of sales was decomposed into manufacturing costs as a percentage of sales (MES) and non-manufacturing (period) costs as a percentage of sales (NMES). The means of MES for the 72 Japanese (76.54%) and 72 matched domestic firms (69.95%) are significantly different on the basis of a Student's t-test (t = 2.39, p = 0.018, n = 144). The means for NMES of the same Japanese (26.16%) and domestic firms (23.79%), do not differ significantly (t = 0.56, p = 0.62, n = 144). [Note: 100% (Sales)-MES = GPMG; and 100%-(MES+NMES) = NPMG].

Figure 4
JETRO Survey of profitability of Japanese subsidiaries in Europe*



*Note: The data is derived from companies responding to the profitability questions in the JETRO surveys. Sample sizes for the nine periods are, 114, 154, 204, 236, 303, 401, 416, 449 ad 421 respectively.
Source: JETRO (1996)

ble' economy collapsed in 1990, and the early 1990s saw slow domestic growth and a fall in stock prices. The economic downturn was accompanied by further appreciation of the yen against major world currencies, and increasing pressure on Japanese corporations in Japan to restructure and reduce production costs (Norimoto, 1996).

Pressure on Japanese parent firms, combined with the recession in Europe, undoubtedly affected prospects in European (and US) based Japanese subsidiaries (see Norimoto, 1996; Morris et al., 1993). The poor profitability of Japanese subsidiaries in this period in both Europe and the US is evidenced from a number of sources. The Japanese External Trade Organisation (JETRO) provides regular survey-based reports on the business situation of Japanese manufacturing affiliates across Europe.

The JETRO (1996) report surveyed 437 Japanese manufacturers across Europe, and asked companies to provide details of their latest profit position (i.e. for the 1994–95 financial year). The survey reported that 15% of firms had a large profit surplus, 42.5% a small surplus, 8.8% broke even, 20% had a small deficit and 13.8% had a large deficit. The results showed an improvement on the previous JETRO survey (covering 1993/94), when 50.3% of responding firms reported a deficit.

Improvements between these periods reflected an improvement in European business conditions. At the same time, it is important to note that the proportion of Japanese companies in Europe making either losses or breaking even according to previous JETRO reports has averaged around 48% since the first survey was undertaken in 1984 (Figure 4), with several survey periods covering strong growth conditions in Europe. While special conditions clearly affected Japanese subsidiary profitability in 1993 and 1994, Figure 4 illustrates that poor profitability in Europe is not restricted to any one year.[7]

Furthermore, the poor comparative performance of Japanese subsidiaries in 1994 was not confined to Europe. Data collected by the US Department of Commerce (1996) show the net income and sales of Japanese, Canadian and European non-bank affiliates operating in the US in 1994. It reveals that, in total, Japanese non-bank affiliates had negative net income before tax amounting to \$768m on total sales of \$388,713m in 1994 (a return on sales of −0.2%). Over the same period, Canadian and European non-bank affiliates in the US had return on sales figures of 2.2% and 1% respectively.

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[7] To compare comparative profitability in the two other (after the UK) most important locations for Japanese manufacturing subsidiaries in Europe (France and Germany)—together comprising 30% of Japanese manufacturing subsidiaries in the EU in 1994—two samples of Japanese manufacturing subsidiaries were derived from the Dun and Bradstreet (1996) ***Europa*** report, which were then cross-checked against Japanese subsidiary listings in an earlier JETRO (1993) survey report. For France, the sample comprised 29 manufacturing subsidiaries, employing 11,654 people, and for Germany, 24 subsidiaries, employing 14,392 people. Profit and sales figures for these subsidiaries were available for either 1993 or 1994 for each subsidiary. In the French case, 51.7% of the selected Japanese subsidiaries were making a loss, and the mean net profit (before tax) margin was only 0.6%. In the German case, 37.5% of subsidiaries were making losses, with a mean net profit margin of just 0.2%. The corporation tax rates in France and Germany were 34% and 50% respectively in 1993.

In the manufacturing sector, Japanese subsidiaries in 1994 made total losses of \$105m on total assets of \$79,863m (a return of −0.1%). Comparative return on assets figures for Canadian and European manufacturing affiliates in the US were 3.6% and 1.2% respectively. Poor comparative Japanese profitability in the US, as in Europe, was not restricted to 1994 alone. For example, using US Department of Commerce Statistics, Haslam et al. (1995) reported that, in aggregate, Japanese subsidiaries in the US had net profit (before tax) margins of 0.11, 0.25, and −1.73% in 1978, 1984 and 1989 respectively. Over the same years, their European counterparts had substantially higher margins of 3.17, 2.00 and 1.73% respectively. Furthermore, by 1991, the US recession had reduced the profitability of Japanese subsidiaries, which were then making an average 5.4% net loss on sales, while their EU counterparts restricted net losses on sales to 0.32%.

The above evidence highlights that poor Japanese subsidiary performance was replicated in other global locations apart from the UK in the 1993/94 period. However, the evidence also demonstrates that Japanese subsidiaries have been characterised by poor comparative profitability in the US and Europe for a number of years. Haslam et al. (1995) attribute the continued poor profit performance of Japanese subsidiaries in the US to transfer pricing policy. This finding is supported by Oyelere and Emmanuel (1996: 8), who noted that 'the US Treasury believed that \$100bn of taxes had been avoided by 36 multinationals, two-thirds of them Japanese, by manipulating transfer prices during the period 1980 to 1990'.

As noted above, the results presented in this paper provide prima facie evidence of transfer pricing manipulation. This conclusion is supported from other UK sources relating to earlier periods, with Oyelere and Emmanuel (1996) also reporting that less than £40m in tax was collected from the 10 largest Japanese companies in the UK over the periods 1988/89 and 1990/91. This amounted to just 0.6% of their combined turnover.

One way to examine this hypothesis in more detail than attempted in the current study would be to analyse whether the profitability differential between matched samples of Japanese and domestic subsidiaries is lower in low tax countries, and higher in high tax countries. Such an extended analysis is beyond the scope[8] of the current study, and is based on the premise that the prime motivation for manipulative transfer pricing among Japanese firms is deliberate tax minimisation. In this context, the extant literature on the roles of transfer pricing indicate that, in addition to minimisation of tax (including Customs and Excise taxes), transfer pricing may be utilised, inter alia, to concentrate cash centrally, to reduce inflation and exchange risk, and to avoid dividend restrictions (Oyelere and Emmanuel, 1996). For example, Buckley and Hughes (1997: 15), hypothesise that the Japanese do not engage in transfer pricing to deliberately minimise UK tax liability. Rather they conclude that it is the generation of profit for the home-based parent which drives the internal pricing structure—a factor which transcends any ideas of individual unit or national boundaries—and is based on prevailing Japanese business culture. In these circumstances, Buckley and Hughes state that the Japanese firm is seen as a collective body, and the notion of its overseas subsidiary as a profit centre would be viewed as dysfunctional.

There is clearly some merit in this contribution, particularly when comparison of 1994 effective corporation tax rates—33% in the UK, 41% in the US and 50% in Japan (Keizai-Koho Centre, 1997)—would tend to indicate that, prima facie, minimisation of global tax liability would favour Japanese firms declaring more profit in the UK and US. Furthermore, avoidance of exchange rate risks, particularly in a period of yen appreciation, has been a consideration for Japanese subsidiaries located in the UK and Europe. The JETRO (1996) survey (above) reported that 40.2% of responding Japanese subsidiaries in Europe were having to take affirmative action to manage exchange rate risks (including 46.4% of the UK respondents in the survey).

Although the nature of the 'affirmative action' was not specified, it is possible that this provides a motivation for realising cash[9] in Japan as quickly as possible (and is therefore consistent with the roles of transfer pricing mentioned above). Also noteworthy is the fact that the JETRO (1996) survey shows that the sectors worst affected by exchange rate variations included transport equipment, electrical engineering and transport and electronic components—all sectors well represented in the UK sample covered in this study (see Figure 2).

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[8] We are grateful to a referee for raising this suggestion. As well as presenting a considerable logistical exercise, problems may also arise in relation to exact comparisons of profit rates for matched samples of Japanese and domestic firms across high and low tax countries because of different accounting regulations and disclosure regimes (Emmanuel and Mehafdi, 1994).

[9] In a recent theoretical paper, Weisfelder (1994) demonstrates how differences in home country fiscal regimes can result in variations in the cost of cash transfers by multinational companies across different countries.

To combat transfer pricing abuses (for whatever reason) on intra-group trading, section 770 of the 1988 Income and Corporation Taxes Act allows the Inland Revenue[10] to adjust the taxable income of a Japanese (or any other) subsidiary to the figures[11] that would have resulted if input prices had been agreed between two unrelated parties (Buckley and Hughes, 1997: 14). Clearly any such adjustments may be difficult to make because of problems in establishing what the market price for some intermediate inputs would actually be, with Japanese firms having a preference for cost-based approaches to transfer pricing because of this difficulty (Bromwich and Inoue, 1994). Although the UK government is currently examining ways of tightening procedures[12] for collecting appropriate tax revenues (Bruce, 1997), the problems posed by such practical issues indicate that transfer pricing abuse will be with us for some time to come.[13]

3.1.4. Solvency, gearing and risk characteristics

Table 4 reports summary statistics relating to days' debtors (DAYD, that is, the number of days' sales represented by outstanding debtors), together with days' creditors (DAYC, that is, the number of days' sales represented by credit from suppliers). It shows that there are no significant differences between the samples for days' debtors, but that the number of outstanding days' creditors in the domestic sample is, on average, significantly higher than in the Japanese sample. Hence, Japanese firms tend to pay their suppliers more quickly (which may, of course, be to the parent company or a related subsidiary) than their matched domestic counterparts, resulting in an increased cash flow for the latter.

In respect of the two standard corporate liquidity/solvency variables (CURA, QRAT), Table 4 reveals that domestic firms exhibit higher mean and median ratios than their Japanese counterparts, but that only the median values differ significantly between the samples at conventional levels. Overall, these results suggest that Japanese companies are less solvent than their domestic counterparts, a finding which is examined in more detail below in relation to credit ratings.

Turning to the gearing and financial risk characteristics, Table 4 shows that Japanese firms exhibit higher gearing ratios (GEAR) than their domestic counterparts (although not significantly so). However, the mean and median values of interest cover (ICOV) are significantly higher (that is, financial risk is significantly lower) in the domestic sample; although, due to the large variance around the mean, the median value of ICOV is perhaps more appropriate as a measure of central tendency. Consistent with the preceding analysis, the credit risk (CRISK) of Japanese firms is significantly higher (mean = 41.5) than for matched domestic firms (mean = 56.6).

Table 5 provides further information on CRISK with reference to the proportions of firms in each of the five credit risk categories on the FAME database. It shows that (consistent with the preceding analysis) the two samples differ significantly (chi-square test significant at $p = 0.000$) with reference to the distribution of firms in the various risk categories. In particular, only 2.1% of domestic firms were classified as being of high risk (that is, assessed as likely to fail without remedial action) compared with 19.8% of Japanese firms. Furthermore, 22.9% and 34.4% of domestic subsidiaries were classified as 'caution' and 'normal' credit risks, compared with 37.5% and 18.8% of Japanese firms respectively. These results suggest that Japanese firms (on average) may experience more difficulty in obtaining credit, from both loan and trade creditors, than their domestic counterparts—a conclusion receiving some support from the earlier finding that Japanese firms exhibit significantly lower mean and median values for days' creditors (DAYC) than domestic firms. The determinants of credit rating scores are examined in more detail below.

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[10] In this context, Oyelere and Emmanuel (1996: 20) have noted that: 'Past tax audit investigations in this area are also veiled in confidentiality. The assumption is that Inland Revenue inspectors through their regular discussions with MNEs will effectively control what is acceptable transfer pricing.'

[11] Although UK auditors have no specific duties to investigate potential transfer pricing manipulation, under the Statements of Auditing Standards (SASs), issued by the Auditing Practices Board (see ICAEW, 1996): 'the auditors should plan and perform the audit with the objective of obtaining sufficient audit evidence regarding the adequacy of the disclosure of related party transactions and control of the entity in the financial statements' (SAS 460.1). In this context, SAS 460.12 specifies that 'the directors are responsible for the identification of related party transactions...for example...the entity may be engaged in transfers of goods and services with related parties in accordance with specified transfer pricing policies or under reciprocal trading...'

[12] In commenting on the Inland Revenue's recent drive to increase tax revenue, the UK head of KPMG tax operations (Barlow, 1997) noted that 'half of all corporation tax receipts are collected from little more than 400 companies, so clearly it makes sense for the Revenue to concentrate their attention in this area. Companies with substantial international involvement are also vulnerable, because of the scope for dispute over transfer pricing issues...'.

[13] Clearly, empirical evidence gleaned from audited annual accounts provides only prima facie (and indirect) evidence of transfer pricing abuse. In this context, Emmanuel and Mehafdi (1994: 56) have stated that: 'Precisely gauging the significance of intra-group transactions is not easy. Cases which do come to the courts have a tendency to be settled before the full details of transfer pricing are disclosed....MNE tax returns are not in the public domain and accounting disclosure policies concerning transfer pricing have yet to be harmonised.'

Table 4
Liquidity, solvency, gearing and risk characteristics

	Japanese		*Domestic*		*Significance tests*	
Variables	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[1] (st. dev.)**	**Median (n=)**	**Mean[2]**	**Median[3]**
DAYD	52.40 (37.96)	50.31 (n=91)	55.68 (30.70)	54.39 (n=91)	0.64 (0.523)	0.74 (0.373)
DAYC	28.53** (24.79)	20.83*** (n=94)	36.85** (21.84)	36.70*** (n=94)	2.44 (0.016)	9.38 (0.002)
CURA	1.50 (1.18)	1.13* (n=96)	1.57 (0.97)	1.31* (n=96)	0.44 (0.657)	3.52 (0.061)
QRAT	0.961 (0.81)	0.723** (n=95)	1.11 (0.86)	0.878** (n=95)	1.25 (0.212)	4.13 (0.042)
GEAR	0.787 (0.536)	0.741 (n=96)	0.694 (0.337)	0.686 (n=96)	1.43 (0.153)	0.52 (0.471)
ICOV	8.9** (45.96)	1.19*** (n=62)	213.4** (765.8)	4.85*** (n=62)	2.10 (0.040)	9.32 (0.002)
CRISK	41.54*** (27.70)	36.00*** (n=96)	56.57*** (20.29)	56.50*** (n=96)	4.29 (0.000)	17.52 (0.000)

[1]Means are unbracketed with associated standard deviations shown in parenthesis.
[2]T-values are unbracketed with associated probabilities shown in parenthesis.
[3]Chi-square values are unbracketed with associated probabilities shown in parenthesis.
***,**,*Indicates mean and median values are significantly different at the 1%, 5% and 10% levels respectively. (Student's t-tests for means and chi-square tests for medians.)

Table 5
Credit risk assessment: sample characteristics

Risk Assessment (Credit score)	*Japanese* (n=96) %*	*Domestic* (n=96) %*
High-risk (0-20)	19.8%	2.1%
Caution (21-40)	37.5%	22.9%
Normal (41-60)	18.8%	34.4%
Stable (61-80)	10.4%	27.1%
Secure (81-100)	13.5%	13.5%

*Chi-square=28.7 (p=0.000)

3.1.5. Multivariate analysis

To investigate the determinants of credit risk in more detail, multivariate ordinary least squares (OLS) regression models were estimated, with CRISK as the dependent variable. The objective of this analysis is to examine whether, after controlling for other firm-specific factors which may influence the assessment of credit risk, the ownership status (Japanese versus domestic) significantly affects CRISK. On the basis of a stepwise regression, Table 6 shows that five previously analysed variables are significantly associated with the credit risk score. The signs on the coefficients of these variables are all consistent with prior expectations.

Hence, on average, more profitable companies (RETCE), and those with higher net profit per employee (NPEM), obtained higher credit (lower risk) scores; whereas higher gearing (GEAR) is associated significantly with lower credit (higher risk) scores. Also, consistent with prior expectations, higher solvency/liquidity (QRAT) is associated with higher credit scores (lower risk). To examine the incremental impact of corporate status,

Table 6
OLS multivariate determinants of credit score‡

RETCE	*GEAR*	*QRAT*	*NPEM*	*JDUM*	*CONSTANT*
0.387*** (4.75)	−15.47*** (5.83)	11.21*** (7.96)	2.38E-04** (2.39)	−6.97*** (3.22)	49.46*** (14.82)

$R^2=0.731$; R^2Adj. $=0.722$; $F=85.8(p=0.000)$; $N=170$

‡Variable coefficients are unbracketed with t-values shown in parenthesis.
***,**Indicates variable coefficients are statistically significant at the 1% and 5% levels respectively (two-tailed tests).

Table 7
Multivariate logit models[1]

Variables	*Model 1†*	*Model 2†*	*Model 3†*
EMP	−0.0004* (3.11) [p=0.077]	−0.0004 (2.52) [p=0.112]	−0.0004 (2.37) [p=0.123]
SALEM	1.66E-05*** (17.65) [p=0.011]	1.82E-05*** (20.67) [p=0.000]	
TUFA	−0.077*** (6.33) [p=0.011]	−0.095*** (8.64) [p=0.003]	−0.049** (3.80) [p=0.051]
RETCE	−0.045*** (10.34) [p=0.0001]	−0.019 (0.328) [p=0.567]	−0.023 (1.51) [p=0.219]
DAYC	−0.022*** (6.47) [p=0.00]	−0.026*** (8.34) [p=0.003]	−0.019** (4.70) [p=0.030]
CRISK		−0.031*** (7.87) [p=0.005]	−0.025** (5.66) [p=0.017]
REMS			−0.067*** (14.97) [p=0.000]
AVREM			7.69E-05** (4.31) [0.038]
CONSTANT	0.315 (0.49) [p=0.481]	1.801*** (6.59) [p=0.011]	2.882*** (8.29) [p=0.004]
N=	168	166	166
Chi-square	58.03*** [p=0.000]	66.71*** [p=0.000]	55.14*** [p=0.000]

†Variable coefficients are unbracketed with associated t-values shown in round brackets and probabilities (p) shown in square brackets.
***,**,*Indicates variable coefficients (and model chi-square statistics) are statistically significant at the 1%, 5% and 10% levels respectively (two-tailed tests for variable coefficients).
[1]Dependent variable is coded as one for Japanese firms and zero for domestic firms.

a dummy variable (JDUM, with Japanese subsidiaries coded one, and domestic subsidiaries coded zero) was included in the model. Table 6 shows that after controlling for other relevant factors, Japanese firms are associated with a significantly lower credit score—on average, some 6.97 percentage points lower. The model also explains a high proportion (72.2%) of CRISK variance. Because it is well documented in the corporate failure literature that the probability of corporate failure decreases with size and with age (see, for example, Hudson, 1987), the size (TURN) and age[14] (AGE) of companies were included as additional explanatory variables in the regression model. Although both variables exhibit the expected signs (that is, younger companies were associated with higher credit risk, whereas larger firms were associated with lower risk), the coefficients of TURN and AGE are not significantly different from zero.

Overall, the multivariate regression analysis demonstrates that, relative to matched domestic firms, and after controlling for other significant variables, Japanese firms are, on average, associated with a significantly higher credit risk assessment. They may therefore experience more difficulty in raising finance than their domestic counterparts (at least from loan and trade creditors)—a conclusion supported by the earlier analysis on days' creditors (DAYC). Clearly, however, this observation would not obtain to credit/loans provided by the parent (or associated) companies of the Japanese subsidiaries concerned.

Logit analysis was also conducted to examine in a multivariate framework the characteristics of Japanese firms (coded one in the logit models) relative to their matched domestic counterparts (coded zero). Because of anticipated multicollinearity between some of the explanatory variables, three logit models are presented in Table 7. Model 1 (which excludes CRISK) shows that five variables (from those previously discussed) are significantly associated with corporate status (JDUM), and all exhibit coefficient signs that are consistent with the univariate analysis. More specifically, on average, subsidiaries with more employees (EMP), a higher fixed-asset turnover ratio (TUFA), a higher return on capital employed (RETCE), with more outstanding (days') credit from suppliers (DAYC), and with lower sales per employee (SALEM), are significantly associated with domestic ownership (relative to Japanese ownership).

Model 2 in Table 7 shows the impact of adding the credit score variable (CRISK) to Model 1. Because of multicollinearity between variables (particularly between RETCE and CRISK, which is anticipated given the results in Table 6), the coefficients of RETCE and EMP lose statistical significance. However, Table 7 reveals that all other variables in Model 2 exhibit their expected signs, with Japanese subsidiaries again being associated with higher credit risk. The final model reported in Table 7 (Model 3) demonstrates that the variables REMS and AVREM are significantly associated with corporate status (JDUM), when SALEM is omitted from the logit equations, and exhibit the expected signs—that is, Japanese subsidiaries are associated with higher average employee pay rates (AVREM), together with a lower wage bill to turnover ratio (REMS). However, due to these variables being collinear with SALEM, they are not significantly associated with the dependent variable (JDUM) when the SALEM is included in the logit models. Overall, the multivariate logit analysis supports the univariate analysis and demonstrates that the explanatory variables are able to discriminate significantly (with all model chi-square statistics highly significant at $p<0.01$) between Japanese subsidiaries and their matched domestic counterparts.

3.2. Population characteristics

To investigate whether some of the key findings of the preceding matched sub-sample analysis hold in respect of the population of companies on the FAME database, the FAME software was used to examine the characteristics of all the Japanese, other foreign-owned, and British companies contained in the database. The software was used to generate frequency statistics on loss-making firms (negative net profit before tax), failure rates and credit risk scores. To ensure that the companies in each sub-sample are compared over a common time frame, all firms (44,821) with a primary or secondary[15] manufacturing SIC code, and with account year ends falling in the period April 1994 to March 1995, were initially selected for analysis. As well as examining the relative characteristics of Japanese and other foreign-owned subsidiaries, the analysis of British-owned companies is conducted according to whether they are independent (not held as a subsidiary) or are held as subsidiaries.[16]

Table 8 reports the proportion of firms (excluding failed ones, see Table 10) which were loss-making in the period analysed. Chi-square tests re-

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[14] AGE is defined as the number of years each subsidiary has been in existence (in 1994) since the year that it was incorporated (see appendix). Perhaps not surprisingly, on the basis of a Student's t-test, the average age of the domestic subsidiaries (37.4 years) is significantly higher (at $p=0.000$) than the matched Japanese firms (17.8 years).

[15] The FAME database facilitates searches against both *primary* and *secondary* SIC codes. A company with a secondary SIC manufacturing code is one which is involved in manufacturing activities, but whose primary SIC code is outside manufacturing.

[16] FAME has separate search procedures for: (a) independent firms; (b) foreign-owned subsidiaries; and (c) country of ownership for foreign-owned subsidiaries.

Table 8
Loss-making manufacturing firms 1994/5[1]

Samples		*Percentage loss-making*[2]
1. Japanese subsidiaries:		
	Primary SIC code	40.3% (n = 159)
	Secondary SIC code	33.3% (n = 30)
2. Other foreign-owned subsidiaries:		
	Primary SIC code	25.8% (n = 3,293)
	Secondary SIC code	38.6% (n = 634)
3. British-owned subsidiaries:		
	Primary SIC code	18.9% (n = 4,473)
	Secondary SIC code	23.4% (n = 981)
4. Independent British firms:		
	Primary SIC code	22.2% (n = 12,976)
	Secondary SIC code	29.4% (n = 4,351)

[1]Analysis is based on all firms on the FAME database with a primary or secondary manufacturing SIC code, with account year ends falling in the period 1.4.94 to 31.3.95, which disclosed their net profit before tax figure. All failed firms analysed in Table 10 are excluded.
[2]Percentages refer to the proportion of firms (shown in parenthesis) that were loss-making (negative net profit before tax).

vealed significant differences across the four sub-samples for firms with both primary and secondary SIC codes.[17] More specifically, a significantly higher proportion (40.3%, n = 159) of Japanese subsidiaries with primary manufacturing SIC codes were loss-making than were other foreign-owned subsidiaries (25.8%, n = 4,147). Furthermore, a significantly higher proportion of both Japanese and other foreign-owned subsidiaries were loss-making than British subsidiaries (18.9% n = 4,473), and independent British firms (22.2%, n = 12,976). These results confirm that foreign-owned manufacturing firms (and particularly Japanese ones[18]) are much more likely to declare losses. This provides further support for the earlier finding, based on the matched sample analysis, that transfer pricing may be occurring. However, it is interesting to note that Table 8 shows that for more diversified firms (i.e. with secondary SIC codes in manufacturing), a lower proportion of Japanese subsidiaries were loss-making (33.3%, n = 30) than were other foreign-owned firms (38.6%, n = 634); but that these proportions are still significantly higher than for both independent British firms (29.4%, n = 4,351) and British subsidiaries (23.4%, n = 981).

Table 9 focuses on all those firms (excluding failed ones) with a primary manufacturing SIC code which received a credit risk score (n = 28,203) in the period analysed. It shows that, consistent with the matched sub-sample analysis (and the preceding discussion of loss-making firms), Japanese subsidiaries display significantly worse credit risk scores (14.5% 'high risk'; 9% 'secure') than British subsidiaries[19] (5.3% and 20.3%) and independent British firms (6.6% and 16.9%). Consistent with this, other foreign-owned subsidiaries (while exhibiting significantly healthier credit risk

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[17] For the four primary SIC samples: chi-square = 82.5 (p = 0.000). For the four secondary SIC samples: chi-square = 43.1 (p = 0.000).

[18] Also noteworthy is the fact that the FAME population statistics for loss-making Japanese (40.3%) and British (19.0%) subsidiaries are not dissimilar to those reported in Table 2 for the matched sub-samples (46.4% and 19.6% respectively).

[19] A chi-square test on the four sub-samples (Japanese v other foreign-owned v British subsidiaries v British independent firms) across the five credit score categories was highly significant: chi-square = 300.3 (p = 0.000).

Table 9
Credit risk assessment: all manufacturing firms 1994/5*

Risk assessment (credit score)	*Japanese subsidiaries (n=166)*	*Other foreign-owned subsidiaries (n=3,787)*	*All foreign-owned subsidiaries (n=3,953)*	*British subsidiaries (n=4,942)*	*Independent British firms (n=19,308)*	*All British firms (n=24,250)*	*All firms (n=28,203)*
High-risk (0-20)	14.5% (n=24)	10.3% (n=290)	10.5% (n=414)	5.3% (n=261)	6.6% (n=1,276)	6.3% (n=1,537)	6.9% (n=1,951)
Caution (21-40)	39.8% (n=66)	25.6% (n=971)	26.2% (n=1,037)	17.7% (n=876)	26.1% (n=5,033)	24.4% (n=5,909)	24.6% (n=6,946)
Normal (41-60)	24.1% (n=40)	27.9% (n=1,057)	27.8% (n=1,097)	32.2% (n=1,592)	32.2% (n=6,217)	32.2% (n=7,809)	31.6% (n=8,906)
Stable (61-80)	12.6% (n=21)	19.2% (n=726)	18.9% (n=747)	24.5% (n=1,212)	18.2% (n=3,524)	19.5% (n=4,736)	19.4% (n=5,483)
Secure (81-100)	9.0% (n=15)	17.0% (n=643)	16.6% (n=658)	20.3% (n=1,001)	16.9% (n=3,258)	17.6% (n=4,259)	17.4% (n=4,917)

*Analysis is based on all firms on the FAME database with primary manufacturing SIC codes and with annual account year ends falling in the period 1.4.94 to 31.3.95. All failed firms analysed in Table 10 are excluded, since no risk assessment is given for failed firms,

scores than Japanese subsidiaries) are also characterised by worse credit ratings (10.3% 'high risk'; 17% 'secure') than both British independent and subsidiary firms. Table 9 also shows that 6.9% of all the firms analysed (n=28,203) are classified as high credit risks (i.e. likely to fail without remedial action), but that a significantly higher proportion of foreign-owned subsidiaries fall in this risk category (10.5%, n=3,953), than do British firms (6.3%, n=24,250).

Given that a significantly higher proportion of foreign-owned (particularly Japanese) firms were loss-making and exhibited high risk credit scores, it might be expected that they would be more failure prone. Table 10 therefore reports the 1994/95 failure rates for the various samples. For all firms with primary SIC codes, it shows that the failure rate in the Japanese sub-sample (0.60%) is lower[20] than for other foreign-owned subsidiaries (0.86%), and for both British independent firms (0.98%) and British subsidiaries (0.64%). For companies with secondary SIC codes, Table 10 reveals that two (5.3%) of the 38 Japanese subsidiaries failed, which is higher than for other foreign-owned subsidiaries (0.71%), British subsidiaries (1.47%) and British independent firms (1.38%).

Overall, however, the evidence on comparative failure rates (at least for companies whose predominant activity is manufacturing) is not consistent with prior expectations. There is no systematic evidence, despite foreign-owned firms (particularly the Japanese) being associated with higher credit risk, and being more prone to make losses, that Japanese and other foreign-owned subsidiaries suffer higher failure rates than their domestic counterparts.

A possible explanation of these findings is that Japanese and other foreign-owned subsidiaries are 'objectively' more failure prone, but receive more support from their parent organisations. An alternative explanation, as hypothesised above, is that transfer pricing strategies reduce the 'objective' profitability and financial health of a number of foreign-owned subsidiaries, resulting in poor disclosed profitability, and credit assessments, which mask their true underlying financial health.

4. Conclusions

The new evidence presented in this paper raises a number of important points. In comparison with their matched domestic counterparts, Japanese subsidiaries were found to be generating a relatively high level of sales from a given employment base. The subsidiaries analysed had similar levels of assets, but in terms of returns generated from these assets, it was domestic subsidiaries that outperformed their Japanese counterparts. Japanese subsidiaries had smaller workforces than their domestic counterparts, and a lower wage bill to sales ratio, despite actually paying their employees more. Contrary to expectations, Japanese subsid-

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[20] Because of low frequency counts in the foreign-owned subsamples (and that the expected frequency in the independent British sub-sample is zero), chi-square significance tests could not be conducted.

Table 10
Manufacturing corporate deaths: failures and closures 1994/5[1]

	Proportion (%) and number failing/closing[3]
1. Japanese subsidiaries[2]	
Primary SIC code (n = 167)	0.598% (n = 1)
Secondary SIC code (n = 38)	5.263% (n = 2)
All firms (n = 205)	1.463% (n = 3)
2. Other foreign-owned subsidiaries[2]	
Primary SIC code (n = 3,827)	0.862% (n = 33)
Secondary SIC code (n = 993)	0.705% (n = 7)
All firms (n = 4,820)	0.830% (n = 40)
3. British-owned subsidiaries[2]	
Primary SIC code (n = 4,980)	0.643% (n = 32)
Secondary SIC code (n = 1,428)	1.471% (n = 21)
All firms (n = 6,408)	0.827% (n = 53)
4. Independent British firms[2]	
Primary SIC code (n = 19,528)	0.978% (n = 191)
Secondary SIC code (n = 11,324)	1.378% (n = 156)
All firms (n = 30,852)	1.125% (n = 347)
5. All manufacturing firms[2]	
Primary SIC code (n = 28,502)	0.902% (n = 257)
Secondary SIC code (n = 13,783)	1.349% (n = 186)
All firms (n = 42,285)	1.048% (n = 443)

[1] The analysis is based on all the firms on the FAME database with a primary or secondary manufacturing SIC code and with annual account year ends falling in the period 1.4.94 to 31.3.95.
[2] n = the total number of firms in each category (including failures/closures).
[3] n = the number of corporate deaths (liquidation/insolvency/ceased trading/receivership and administration) in each category. Percentages refer to the proportion (%) of deaths in each category, that is, relative to all firms in each category.

iaries held relatively high stocks, and also performed comparatively badly on a number of liquidity indicators. Japanese subsidiaries were also characterised by significantly higher measures of credit and financial risk.

Return on capital employed in the Japanese sub-sample averaged just over −0.26% compared with 10.77% for domestic subsidiaries. In total, annual taxable profits in the Japanese sub-sample amounted to just £2.3m, some 98 times lower than the matched domestic sub-sample. Poor recorded profitability was found to be a key determinant of the poor credit scores accorded to Japanese subsidiaries, with reported information suggesting that a substantial proportion (19.8%) of Japanese subsidiaries were not in a position to continue trading without external support.

Findings on profitability and credit risk were confirmed when the population of Japanese, other foreign-owned and domestic manufacturing firms on the FAME database were analysed. Over 40% of Japanese subsidiaries were discovered to be loss-making, a significantly higher proportion than that found for other foreign-owned subsidiaries and domestic firms. Interestingly, however, Japanese firms, despite their relatively high credit risk and relatively poor profitability, were not found to be more failure prone than domestic (or other foreign-owned) firms. This analysis, together with the other findings discussed and analysed in this paper, offer prima facie evidence of transfer pricing manipulation.

The short-term success of the UK's policy of subsidising and encouraging Japanese FDI as a means of promoting regional and national development revolves around the ability of these firms to create quality employment that is truly additional. There is evidence that Japanese FDI has been successful in this respect in the UK (Strange, 1993; Morris et al., 1993). However, the longer-term potential for such firms to create real spillover advantages for the UK manufacturing base (i.e. in terms of enhancing the competitiveness of the domestic sector) is questionable if such investors are shown to be performing inadequately relative to matched domestic competition. However, this paper has illustrated that there is a dichotomy between the comparatively high productivity characteristics of Japanese firms and their relatively poor profit performance.

The empirical results presented in this paper are also supportive of the view (Piper, 1996) that Japanese subsidiaries in the UK pay only a fraction of the tax of their domestic counterparts. This finding was also supported by secondary survey and statistical evidence, which demonstrated that comparatively poor profitability among Japanese subsidiaries is not limited to either the UK, or to one time period. Whether the manipulation of transfer prices in the UK reflect a deliberate desire to minimise tax liability, to mitigate exchange rate risks, or simply reflects the collectivist culture of Japanese enterprise, remains a matter of concern for the Exchequer. In this context, although the evidence presented in this paper was derived from the audited accounts of companies prepared on a 'true and fair' basis, it is only the Inland Revenue that can accurately establish the degree to which the poor profitability of Japanese subsidiaries results from transfer pricing manipulation.

Clearly, further research into the comparative performance of Japanese-owned subsidiaries is needed in the light of the claims made for these subsidiaries in terms of productivity and efficiency. A limitation of this study is that its conclusion is based on data for one year. Initially, research might seek to examine the performance of Japanese and domestically-owned subsidiaries over a longer time period. This would allow the consideration of changes in performance variables through time, and would also permit researchers to consider how subsidiaries react during different phases of the trade cycle. For comparative purposes, such an exercise might also compare Japanese subsidiaries with that of subsidiaries from other nations. Furthermore, there is a need for field research to confirm this paper's conclusions, including an examination of the correlation between subsidiary performance and declared parent company results in Japan.

Appendix

Variable definitions

1. TURN:	Turnover (£000)
2. TASS:	Total assets (£000)
3. FASS:	Fixed assets (£000)
4. EMPL:	Number of employees
5. TOTREM:	Total wage bill (£000)
6. AVREM:	Average employee remuneration (£)
7. SALEM:	Sales (TURN) per employee (£)
8. REMS:	TOTREM/TURN (%)
9. NPEM:	Net profit before tax/EMPL (£)
10. GPEM:	Gross trading profit/EMPL (£)
11. NPMG:	Net profit before tax/TURN (%)
12. LOSS:	1 = Negative net profit before tax; zero otherwise
13. GPMG:	Gross trading profit/TURN (%)
14. RETCE:	Net profit before tax/capital employed (%)
15. TUTA:	TURN/TASS
16. TUFA:	TURN/FASS
17. DAYST:	Days' stock: (stock/sales)*365
18. DAYD:	Collection period: (debtors/sales)*365
19. DAYC:	Credit period (as a proportion of sales): (creditors/sales)*365
20. CURA	Current assets/current liabilities
21. QRAT:	(Current asset-stock)/current liabilities
22. GEAR:	Total liabilities/TASS
23. ICOV:	Net profit before interest and tax/interest paid
24. CRISK:	Credit risk score
25. AGE:	Number of years since incorporation (at 1994)
26. JDUM:	1 = Japanese subsidiary; 0 = matched domestic firm

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The Impact of Irreversibility, Uncertainty and Timing Options on Deprival Valuations and the Detection of Monopoly Profits

Andrew W. Stark*

Abstract—This paper has two purposes. The first is to derive rules identifying the deprival value of an asset (i) which is irreversible to one extent or another; (ii) the benefit stream of which is subject to continuing uncertainty; and (iii) for which an option to wait exists as to when to reacquire should the owner be deprived of it. The second is to consider whether accounting rates of return employing these deprival value rules can be developed to help in the detection of monopoly profits in circumstances where investment decision-making takes place in the presence of irreversibility, uncertainty and the existence of timing options. The 'new' deprival value rules for an asset differ from the 'conventional' ones in that present value less the value of the option to reinvest in the asset appears in the 'new' rules wherever present value appears in the 'conventional' rules. Examples are provided which suggest that 'new' and 'conventional' deprival value rules can differ materially. A further result is that accounting rates of return can be developed using the 'new' deprival value rules that are, in principle, useful in the detection of monopoly profits. Nonetheless, in practice such use requires a level of information that renders the result superfluous in the sense that the provision of replacement cost balance sheet data, combined with the level of information needed, is sufficient to reveal the presence of monopoly profits directly.

1. Introduction

The concept of deprival value (DV) appears well known to not only accounting theorists but also accounting policy-makers. For example, DV was a part of current cost accounting standards in Australia, Canada, New Zealand, the UK and the US. More currently, an extant international accounting standard, IAS 15, contains recommendations about current cost disclosures, where current cost is defined as equivalent to DV (IASC, 1995: 250, para.12). Additionally, in the UK, on the initial consolidation of a firm acquired in a takeover into the acquirer company's accounts, individual assets are initially recognised on the basis of their 'fair value', the latter term then being interpreted to mean DV (FRS 7, 1994). More recently, such recognition is suggested for extension to the (re)valuation of tangible fixed assets in general (ASB, 1996a/b).

On this basis, it seems reasonable to conclude that DV is accepted as a practically applicable valuation basis, which has featured in both past and current accounting standards concerned with accounting for the effects of changing prices in numerous jurisdictions and is currently required practice for other purposes such as the initial valuation of assets acquired through takeover. Nonetheless, Whittington (1983: 136) suggests that DV

> '...is to some extent still a practical technique in search of a theoretical justification, and it requires further analysis and development... value to the owner has never been demonstrated to arise out of a particular information requirement of a potential user of financial reports, other than that of an insurer'.

Recent work by Kay and Mayer (1986), Edwards, Kay and Mayer (1987) and Grinyer and Walker (1990) alters this latter state of affairs. It suggests that under conditions of (at least partial) irreversibility, uncertainty and a timing option, ex ante accounting rates of return, based on a comprehensive income concept and employing deprival values for opening and closing capital, can be used to decide whether to invest in a project.

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Edwards, Kay and Mayer (1987), in particular, then use this suggestion to develop a case for the usefulness of ex post accounting rates of return, again based on a comprehensive income concept and employing deprival values for opening and closing capital, in financial analysis and, specifically, the detection of monopoly profits. If this work is accepted at face value, a demand for the use of DV in financial statements arising out of users' needs can be argued to exist.

Baxter (1993) suggests that the DV concept basically comes from the work of Bonbright (1937) who states:

> 'The value of property to its owner is identical in amount with the adverse value of the entire loss, direct or indirect, that the owner might expect to suffer if he were deprived of the property.'

The conventional rules for identifying the DV of an asset as a practical matter are as follows. DV is replacement cost (RC) if, on being deprived of the asset, the firm would immediately replace it. If, on being deprived of the asset, the firm would not replace it, DV is the higher of (i) the present value of the asset's future cash flows (PV); and (ii) the proceeds of selling the asset, or net realisable value (NRV).

Embedded in these rules for determining 'conventional' DV is a model of optimal investment decision-making. Such a model covers (i) what to do if deprived of the asset; and (ii) what would have been done if the firm had not been deprived of the asset. Thus, optimal behaviour is to replace the asset if either PV or NRV or both is higher than RC. Further, if RC is greater than both PV and NRV, then DV is PV if PV is greater or equal to NRV or, alternatively, NRV if NRV exceeds PV. In other words, it is optimal to reinvest in the asset if either of its PV or NRV are in excess of its RC and it is optimal to disinvest in the asset if its NRV exceeds its PV.

Recent literature in financial economics suggests, however, that the rules for optimal investment and disinvestment decision-making embedded in 'conventional' DV are not generally correct (for example, Brennan and Schwartz, 1985; Dixit, 1989; Majd and Pindyck, 1987; McDonald and Siegel, 1986; Pindyck, 1988; for excellent expositions of the whole area, see Dixit and Pindyck, 1994 and Trigeorgis, 1996). In particular, Dixit (1992: 103) suggests that three features

> '...are common to most investment decisions...First, almost as a matter of definition, an investment entails some sunk cost, an expenditure that cannot be recouped if the action is reversed at a later date. Second, the economic environment has ongoing uncertainty and information arrives gradually. Finally, an investment opportunity does not generally disappear if not taken immediately; the decision is not only whether to invest, but also when to invest. The qualitative implication is easily stated. When these three conditions are present, waiting has positive value.'

In addition, Pindyck (1991: 1,110) states that

> '...the ability to delay an irreversible investment expenditure can profoundly affect the decision to invest. It...invalidates the net present value rule as it is usually taught...: "Invest in a project when the present value of its expected cash flows is at least as large as its cost." This rule—and models based upon it—are incorrect when investments are irreversible and decisions to invest can be postponed.'

As a consequence, Pindyck (1991: 1,112) argues that

> '...the NPV rule "Invest when the value of a unit of capital is at least as large as its purchase and installation cost" must be modified. The value of the unit must *exceed* the purchase and installation cost by an amount equal to the value of keeping the investment option alive.'[1]

The above quotations suggest that investment should only take place when the present value of an asset (PV) exceeds the sum of its cost (RC) and the option to wait (OW) sacrificed if investment takes place immediately. In other words, PV must exceed RC plus OW if immediate investment is unequivocally desirable.

Note also that applying the same logic to the abandonment decision suggests that, on abandonment, the firm gains, first, the disposal proceeds, NRV, and, second, the option to make the investment at some future date—the option to wait (OW), and loses the present value (PV). Hence, abandonment should only take place if NRV plus OW exceeds PV.

Given the preamble above, the purposes of the paper can be turned to. The first purpose is to derive rules for identifying the DV of an asset (i) which is irreversible to one extent or another; (ii) the benefit stream of which is subject to continuing uncertainty; and (iii) for which an option exists as to when to reacquire should the owner be deprived of it. These 'new' DV rules are derived in the light of investment decision-making rules consistent with such circumstances. The second purpose is to consider whether accounting rates of return employing the 'new' DV rules can be developed that are of help in detecting monopoly profits in circumstances where investment decision-making takes place in the presence of irreversibility, uncertainty and the existence of timing options.

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[1] Implicit in Pindyck's (1991) restated rule for investment decision-making is the idea that the market value of a firm will reflect not only the value of the assets in place but also the value of the investment options possessed by the firm. Such an assertion can be related to the statement of Mason and Merton (1985: 38) that '...all capital budgeting procedures have as a common objective the estimation of the price that an asset or project would have if it *were* traded.' This can be logically extended to include the pricing of relevant costs associated with such capital budgeting decisions. Kester (1984) has suggested that investment options can account for up to one half of equity stock market values, if not more, suggesting that such options clearly can be extremely valuable and very material in the aggregate.

The rest of the paper is organised as follows. The next section (Section 2) develops the new set of DV measurement rules. Section 3 provides a worked example to illustrate potential differences between 'new' and 'conventional' DV. Section 4 considers the suitability of accounting rates of return employing 'new' DV for the detection of monopoly profits. The paper concludes with a brief summary of the main points of the paper.

2. Developing 'new' DV measurement rules

2.1. Definitions of PV, OW, NRV and RC

Detailed definitions of the terms PV, OW, NRV and RC, as used in this paper, follow.

Present value. The present value of an asset, at any point in time, is given by discounting the future cash flows associated with the opportunity that are generated by possessing the investment 'now'. The strategy of immediate disposal, however, is excluded from the concept. Hopefully, this idea can be clarified by envisaging the firm as a collection of separable assets in place and options to wait.[2] The value of the firm in a rational market is the present value of the firm's future cash flows. Separability implies that these can be broken down and attributed to each asset in place or option to wait. The present value of an asset, then, is the present value of the future cash flows of the firm that can be attributed to the asset's current possession. It should be emphasised that PV potentially encapsulates the value of all possible opportunities to (optimally) disinvest in/abandon the opportunity at all future feasible points in time and, also, to make follow-on investments such as capacity expansions. Nonetheless, the latter will only be a part of the PV of the asset, and not a separate option to wait, if capacity extensions can only take place in the future if the asset is currently owned.

Option to wait. In similar fashion, the value of the option to wait associated with an asset is the present value of the firm's future cash flows that can be attributed to the opportunity to acquire the asset, or its equivalent, some time in the future. It should be emphasised that OW encapsulates the value of all possible opportunities to (optimally) invest in the asset at all feasible points in time in the future.

Net realisable value. This represents the disposal value of assets. Clearly, there are ambiguities associated with this definition of NRV. NRV is relatively straightforward if it is assumed that disposal can take place immediately. But if such is not the case as when, for example, markets are thin and immediate disposal is not possible, it is difficult to separate the concepts of PV and NRV because, ultimately, if disposal does not take place immediately, it is difficult to see why a firm would be committed to disposing of the asset some time in the future. Even if its intentions are to dispose of an asset, there is no binding commitment to such a course of action. Presumably, the firm would carry on behaving optimally and there is no necessary requirement that future disposal would be optimal. For the sake of the argument below, however, it will be assumed that markets for assets are sufficiently active to allow immediate disposal at some price and NRV represents the proceeds from immediate disposal.

Replacement cost. Here is followed the concept of RC suggested in Edwards, Kay and Mayer (1987) whereby RC refers to the cost of replacing the services yielded by an asset rather the cost of physical replacement.

2.2. Deprival value rules when OW exceeds zero

If OW exceeds zero then, stated symbolically, the investment decision-making rule becomes—invest unequivocally if and only if:

$$\mathrm{PV} > \mathrm{RC} + \mathrm{OW};$$

$$\text{or} \quad (\mathrm{PV} - \mathrm{OW}) > \mathrm{RC} \qquad (1)$$

The economic intuition behind this rule is that, immediately prior to the investment decision, the firm owns an asset which is the investment option. If it exercises this option it loses it and also the purchase and installation costs. In return, it gains the present value of the asset. Naturally, if the firm is economically rational, it will only invest if the latter exceeds the former.

Second, consider the rules for disinvesting in an asset. Should an asset be disposed of, the firm will lose the asset's present value. In its place, the firm will gain the net realisable value of the asset and an option to reinvest in it at some later date, however small the latter might be. The economically rational firm will only disinvest unequivocally if the gains exceed the losses. In other words, disinvest unequivocally if and only if:

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[2] Issues surrounding the separability of assets (and options to wait) produce potentially major difficulties in applying DV rules, whether those conventionally used or those developed below. As a consequence, separability is an issue that raises no more problems, in principle, for the analysis in this paper than it does for other analyses involving DV. The problem of the separability of assets is considered at length by, amongst others, Edwards, Kay and Mayer (1987) and Whittington (1983).

$$\text{NRV} + \text{OW} > \text{PV};$$
$$\text{or} \quad \text{NRV} > (\text{PV} - \text{OW}) \qquad (2)$$

Observe that for both investment and disinvestment rules, the effect of the existence of an option to wait on these procedures is (i) to effectively reduce the PV of the investment by the value of the option to wait; and then (ii) use this reduced amount in place of PV in comparisons with either RC or NRV. The intuition behind the apparent 'netting off' of OW against PV is that, because the acts of holding PV and OW are mutually exclusive, it is impossible to acquire PV without losing OW or, vice versa, lose PV without gaining OW.

At this stage, return to the conceptual definitions adopted for PV and OW. Because the investment decision-making rule nets off OW against PV, it becomes clear that the effective source of value attributed to the asset associated with acquiring it now, when comparing this value with the cost of acquisition, RC, is the difference between the ability to generate cash flows in the future if it is acquired now and the ability to generate cash flows if acquired at some time in the future should circumstances warrant it.

But the above might be thought to beg the following question—if (PV-OW) can essentially be thought of as being derived from an incremental cash flow concept, incremental to the best alternative course of action, is it really any different from some ideas expressed about present value? Perhaps, in principle, the answer to this question is no. Dixit and Pindyck (1994) suggest that it is entirely possible to effectively relabel PV such that it is net of OW. Nonetheless, they, and other authors (including Edwards, Kay and Mayer, 1987), choose not to adopt this relabelling. Rather, the labelling of PV and OW remains distinct and consistent with the definitions offered in this paper.

One possible reason for this is the following argument. The revised decision rules for investment or disinvestment decision-making given above envisage the option to acquire an asset as being completely separable from the asset itself, and that it is not possible to hold both the option to acquire the asset and the asset itself. Further, either the option to wait can be thought of as a derivative security, the underlying security of which is the asset under consideration for purchase (as in, for example, McDonald and Siegel, 1986), or, alternatively, both PV and OW can both be thought of as different derivative securities dependent upon the movement of an underlying state variable (as in, for example, Dixit, 1989). Under either circumstance, it appears difficult to relabel PV as being net of OW. Even if the PV of a separable asset is not to be regarded as a proxy for the contribution of the asset to the rational market value of the firm, as suggested above, but, rather, is to be relabelled as being net of OW, a new term will be needed to describe this proxy if only to think about how to value OW in some circumstances.[3]

Now consider DV measurement rules. First, consider an asset for which RC>NRV.[4] Should the firm be deprived of this asset, inequality (1) suggests that it will only reinvest if (PV-OW)>RC. Thus:

$$(\text{PV} - \text{OW}) > \text{RC} > \text{NRV} \Rightarrow \text{DV} = \text{RC}$$

because the loss borne by the firm is the cost of replacement.

It will not pay to replace, if RC > (PV-OW). Under such circumstances, DV will depend upon the appropriate disposition of the asset in the absence of deprival. From inequality (2), if (PV-OW) > NRV, the firm would have wanted to keep the asset. Hence, in this case, the loss borne is (PV-OW) because, although the firm loses the PV of the asset on deprival, it regains the value of the investment option associated with it. If, alternatively, NRV > (PV-OW), the firm would have been intending to sell the asset. As a consequence, the asset should be valued at the sum of NRV and the value of the investment option to be regained on sale, OW. After deprival, the firm retains the investment option, OW, and, hence, the loss is NRV. Putting these two circumstances together produces

$$\text{RC} > (\text{PV} - \text{OW}) > \text{NRV} \Rightarrow \text{DV} = (\text{PV} - \text{OW})$$
$$\text{RC} > \text{NRV} > (\text{PV} - \text{OW}) \Rightarrow \text{DV} = \text{NRV}$$

Second, the logic of the above analysis can now be applied to the circumstances when NRV > RC, implying that the firm would always wish to

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[3] The above discussion is a consequence of tensions between market value-surrogate and incremental cash flow concepts of PV which are hidden when no option to wait exists. If the latter is the case, the alternative to not investing is to do nothing—here the market value surrogate and incremental cash flow concepts will coincide. If there is an option to wait, the concepts will produce different answers. One attribute of the rational market value surrogate is that the sum of the separable asset (including options to wait) PVs will, in principle, add up to the market value of the firm. This will not be the case if the incremental cash flow concept of PV is invoked.

It needs to be emphasised that an underlying assumption of this paper's analysis is that assets are separable. Although, clearly, this assumption is not fully general, it is useful to illustrate the paper's basic ideas which are concerned primarily with the real option characteristics of many opportunities facing firms.

[4] Note that the whole notion of deprival value requires that the asset in question be at least partially irreversible. If RC is equal to NRV as a matter of course, DV collapses to either RC or, equivalently, NRV.

Table 1
Deprival rules with an option to wait

Circumstance			*Deprival value*
(PV-OW)	> RC	> NRV	DV=RC
RC	> (PV-OW)	> NRV	DV=(PV-OW)
RC	> NRV	> (PV-OW)	DV=NRV
(PV-OW)	> NRV	> RC	DV=RC
NRV	> (PV-OW)	> RC	DV=RC
NRV	> RC	> (PV-OW)	DV=RC

replace the asset of which it has been deprived. The remaining cases give:

$$(PV-OW)>NRV>RC\Rightarrow DV=RC$$
$$NRV>(PV-OW)>RC\Rightarrow DV=RC$$
$$NRV>RC>(PV-OW)\Rightarrow DV=RC$$

Putting all these cases together produces Table 1.

Table 1 makes clear that the amendment necessary to the 'conventional' DV to produce 'new' DV is to replace PV by (PV-OW) when a valuable investment timing option exists.

To complete this section, two further points are made. First, no particular technique for valuing OW is needed for the analysis above. The latter merely assumes the possibility of the existence of a positive value for OW. In turn, a positive value for OW merely requires that the asset under consideration could give rise to a positive net present value with strictly positive probability if invested in at some time in the future. The circumstances in which OW can be positive are returned to below. Second, the value of OW depends on the behaviour of the asset's RC in the future. This is because future replacement costs will affect any comparisons between the value of investing today and the value of waiting. Thus, application of the 'new' DV rules of measurement developed in this paper will require rather more information than the conventional rules.[5]

3. A worked example

The following example is used to illustrate the potential of the 'new' DV rules to produce materially different asset valuations from the conventional ones. Consider the following asset owned by the firm. The asset's cash flows through time are described by the following stochastic process:

$$dC=\alpha Cdt+\sigma Cdz-Cdq \qquad (3)$$

where dz is the normal increment of a Gauss-Wiener process and dq is a Poisson jump process with the characteristic that:

$$\begin{aligned} dq &= 0 \text{ with probability } 1-\lambda dt \\ &= 1 \text{ with probability } \lambda dt \end{aligned} \qquad (4)$$

The process generating the asset's cash flows is assumed to be unaltered by the behaviour of the firm or by any of its competitors.

There are two sources of uncertainty affecting the cash flows in the process. First, there is the normal random fluctuation induced by dz. Second, there is a λdt chance that the cash flows will fall to 0 during any time interval [t, t+dt]. If the Poisson event occurs, the asset is effectively useless, whether owned or not, because $C = 0$ is an absorbing barrier such that once C hits it it can never get away. Further, $1/\lambda$ is the expected time until a Poisson jump and, hence, can be seen as the expected life of the project. dz and dq are assumed statistically independent. If the asset were to be acquired now or in the future, it would cost 1. Once acquired, the project can be abandoned or sold for an amount equal to s $(1 \geq s)$ at any time in the future. The risk-free rate of return is r.

To add some intuition to the modelling of the asset's cash flows, it is worth pointing out that equation (3) suggests that the cash flows are expected to grow exponentially at rate α until the Poisson event occurs, killing the project. Thus, in the absence of such a Poisson event, the project carries on forever.

Using conventional contingent claims analysis (for proofs of the mathematical statements below, see Appendix 1), we can derive:

$$PV=AC^{\theta}+C/(\mu+\lambda-\alpha) \qquad (5)$$

and

$$OW=BC^{\pi} \qquad (6)$$

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[5] Further, if the asset is partially reversible and gives rise to abandonment possibilities, the asset's PV requires a knowledge of the future behaviour of NRVs. Nonetheless, strictly speaking, this information is required under the 'conventional' DV rules of measurement and, hence, is not an additional requirement of the 'new' DV rules developed in this paper.

where

$$\pi = [.5 - ((r - \mu + \alpha)/\sigma^2)] + [[.5 - ((r - \mu + \alpha)/\sigma^2)]^2 + [2(r + \lambda)/\sigma^2]]^{.5} \quad (7)$$

and

$$\theta = [.5 - ((r - \mu + \alpha)/\sigma^2)] - [[.5 - ((r - \mu + \alpha)/\sigma^2)]^2 + [2(r + \lambda)/\sigma^2]]^{.5} \quad (8)$$

and μ is the risk-adjusted expected rate of return on a security or portfolio whose return is perfectly correlated with C. In equation (5), the first term on the right hand side is the value of the abandonment option; the second term is the present value of the asset's future cash flows on the assumption that the asset will be held until the Poisson event occurs. Note that if $\lambda = 0$ (i.e., the project lasts forever) and $\mu > \alpha > 0$, the second term is the traditional dividend growth model in continuous time.

A and B are constants to be calculated. They are calculated jointly with two cash flow levels, C_I and C_A. These cash flow levels have the following characteristics. If the opportunity is not held, investment will take place when C rises up to C_I and, if the opportunity is held, abandonment will take place if C drops down to C_A. The four parameters describing the opportunity, A, B, C_I and C_A, are calculated by applying standard boundary conditions which produce the following four equations:

$$B(C_I)^{\pi} = A(C_I)^{\theta} + C_I/(\mu + \lambda - \alpha) - 1 \quad (9)$$

$$B(C_A)^{\pi} = A(C_A)^{\theta} + C_A/(\mu + \lambda - \alpha) - s \quad (10)$$

$$B\pi(C_I)^{\pi - 1} = A\theta(C_I)^{\theta - 1} + 1/(\mu + \lambda - \alpha) \quad (11)$$

$$B\pi(C_A)^{\pi - 1} = A\theta(C_A)^{\theta - 1} + 1/(\mu + \lambda - \alpha) \quad (12)$$

Therefore, four equations exist in the four unknowns—A, B, C_I and C_A—which can be solved using numerical methods to give the basis for valuing PV and OW as functions of the level of current cash flow, C.

Using these expressions, PV, OW and, hence, (PV-OW) are calculated for a range of current cash flow levels. Once (PV-OW) is calculated, 'new' and 'conventional' DV can be easily derived.

Table 2 shows the values of PV, OW, (PV-OW), 'new' DV and 'conventional' DV for a range of current cash flows from 0.01 to 0.23, with some specific parameter values ($\alpha = 0$; $\lambda = 0.05$; $\mu = 0.13$; $r = 0.05$; $\sigma = 0.3$, $s = 0.25$). The parameter values combined with the cash flow process suggest that future expected cash flows are described by level cash flows (i.e. there is no drift expected in the cash flow stream—it is an annuity with expected life of $(1/\lambda)$ at the current rate per time period with an expected life of 20 ($1/\lambda = 1/0.05 = 20$) time periods). The volatility per time period of future cash flows is 0.3. The cash flows attract a risk premium of 8% over the risk-free rate—suggesting that they are approximately of average market risk.

Nonetheless, these parameter values cannot claim to be uniquely realistic. Little empirical evidence is available on appropriate parameter values for specific projects invested in by firms—let alone whether the example employs realistic assumptions about cash flow processes and the dynamic behaviour of RC and NRV. As a consequence, the example can only be illustrative and not definitive about the potential for differences between 'new' and 'conventional' DV rules in practice.

For this example, $C_A \approx 0.01$ and $C_I \approx 0.23$. In other words, the asset would be acquired if cash flows hit 0.23 and, if already owned, would be abandoned if cash flows fell as low as 0.01. If $C < 0.01$, DV is 0.25 under either DV rule and if $C > 0.23$, DV = 1 under both rules. Thus, the results in Table 2 illustrate a range of cash flow values for which the two DV measurement rules differ in the asset valuations arrived at.

Table 2 suggests that the difference between asset valuations derived from application of the two different versions of DV can differ materially. Not surprisingly, when 'new' and 'conventional' DV differ, 'conventional' DV overstates 'new' DV. 'Conventional' DV is different from 'new' DV by more than 5% for current cash flows between 0.1 and 0.18. The maximum percentage difference is over 12%, when the cash flow level is 0.18.

Although not reported here in detail, further calculations suggest that flexing the parameter values locally around those chosen produces the observations that the maximum percentage difference between 'new' and 'conventional' DV tends to increase, ceteris paribus, as (i) σ increases; (ii) r increases (holding the risk premium constant); (iii) the risk premium (μ-r) decreases; (iv) α increases; and (v) s decreases. Primarily, these effects are produced by the impact of these factors on the wedge between PV and OW for values of cash flow where PV is the asset valuation under 'conventional' DV.

Perhaps more importantly, Gee and Peasnell (1976) argue that under most circumstances, RC will be acceptable as a proxy for DV. Table 2 suggests that the valuation of assets at RC is relatively less likely than might be supposed and relatively more likely to be at (PV-OW). It is quite possible for PV for an asset to exceed RC without implying that the firm would reacquire the asset should it be deprived of it. In these circumstances, RC is straddled by PV and (PV-OW), leading to a 'new' DV equal to (PV-OW) as opposed to a 'conventional' DV of RC.

Table 2
'New' and 'conventional' DV calculations as a function of the current price when RC = 1 and NRV = 0.25

Cash flow	*PV*	*OW*	*(PV-OW)*	*'New' DV*	*'Conventional' DV*
0.01	0.263	0.000	0.263	0.263	0.263
0.02	0.305	0.000	0.305	0.305	0.305
0.03	0.353	0.001	0.352	0.352	0.353
0.04	0.403	0.003	0.400	0.400	0.403
0.05	0.455	0.005	0.450	0.450	0.455
0.06	0.507	0.009	0.498	0.498	0.507
0.07	0.560	0.014	0.546	0.546	0,560
0.08	0.613	0.021	0.592	0.592	0.613
0.09	0.667	0.029	0.638	0.638	0.667
0.10	0.721	0.039	0.682	0.682	0.721
0.11	0.775	0.051	0.724	0.724	0.775
0.12	0.829	0.066	0.763	0.763	0.829
0.13	0.883	0.083	0.800	0.800	0.883
0.14	0.938	0.103	0.835	0.835	0.938
0.15	0.992	0.126	0.866	0.866	0.992
0.16	1.047	0.151	0.896	0.896	1.000
0.17	1.101	0.180	0.921	0.921	1.000
0.18	1.156	0.212	0.944	0.944	1.000
0.19	1.211	0.248	0.963	0.963	1.000
0.20	1.265	0.288	0.977	0.977	1.000
0.21	1.320	0.331	0.989	0.989	1.000
0.22	1.375	0.378	0.997	0.997	1.000
0.23	1.430	0.430	1.000	1.000	1.000

4. Accounting rates of return and the detection of monopoly profits

Kay and Mayer (1986) and Edwards, Kay and Mayer (1987) suggest that a single-period, ex post, accounting rate of return, using deprival value asset valuations and a comprehensive income concept, can be utilised as a tool of financial analysis. In particular, it can be used to identify circumstances where entry barriers are permitting incumbent firms to earn monopoly profits. This work utilises 'conventional' DV measurement rules. In this section it is asked whether the 'new' DV rules can be used in constructing accounting rates of return useful in identifying circumstances when firms are making monopoly profits. To start the analysis, initial consideration of when monopoly profits exist in the presence of irreversibility, uncertainty and timing options is needed.

Edwards, Kay and Mayer (1987: 56–57) assume that entry barriers permit incumbent firms to earn monopoly rents if PV > RC.[6] Given the investment decision-making rules established above, this approach to the identification of monopoly rents implies that either OW has zero value in general or that if OW has positive value then this positive value should be regarded as a part of monopoly rents. The circumstances under which OW has zero value are those in which all investments have at best a zero NPV at all points in time and under all possible contingencies. This might seem consistent with the idea of a competitive equilibrium.

Nonetheless, options to wait can be acquired by previous investment. For example, a firm might invest in research and development activities in order to develop patentable products. It will not automatically, however, choose to produce the new product immediately it is developed and patented; it might well bide its time to introduce its new product onto the market. It has a valuable option to wait that it acquired by investing in research and development activities.[7] Further, although the returns on research and development activities can be a matter of public policy concern, the possibility that options to wait are acquired in exchange for research and development expenditures via a competitive process cannot be ruled out a priori. If it is accepted that options to wait can be competitively acquired in exchange for prior expenditures, an excess of PV over RC is not the appropriate criterion to use in inferring the existence of monopoly rents.[8]

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[6] Implicit in this statement is the author's view that Edwards, Kay and Mayer (1987) view PV in the same light as the definition employed in this paper.

[7] Some would argue that research and development activities allow a firm to develop new products that enable it to act ahead of others with the attendant implication that waiting will not necessarily take place. Nonetheless, for the argument here to go through, all that is required is that there be a degree of flexibility over the timing of a new product launch.

In the analysis below, the appropriate approach to the use of performance indicators, such as accounting rates of return, when attempting to identify monopoly profits is assumed to be similar to the approach in statistics of identifying a null and an alternative hypothesis. Here, the null hypothesis is that no monopoly profits are being earned. This hypothesis also applies to the acquisition of timing options. The alternative hypothesis is that monopoly profits are being earned. Monopoly profits are deemed to exist if (PV-OW) exceeds RC. The performance indicator then produces a 'test' statistic that is used, perhaps in a more judgmental way than in formal statistical methodology, to distinguish between the two hypotheses, given a set of expectations as to what the performance indicator might 'look like' under the null hypothesis. At issue is whether single-period, ex post, accounting rates of return can be used to infer a firm's rational belief at the beginning of a period about the relationship between (PV-OW) and RC.

To investigate this issue, first assume, consistent with Edwards, Kay and Mayer (1987), that NRV > (PV-OW) > RC is impossible. From an economic standpoint, it is not unreasonable to rule out this case as it implies that buying the asset to then resell it immediately (as opposed to using it) is continually profitable. In this case, apparently, at no time would the asset ever be used but yet an infinite arbitrage opportunity is available. The existence of such an opportunity seems economically unreasonable. Second, again consistent with Edwards, Kay and Mayer (1987), assume that investment and disinvestment decisions are made annually. Cash flows arrive at the end of each year. Call two successive points in time one year apart time 0 and time 1. An annual accounting rate of return for the year between time 0 and time 1 will be considered. Third, consider a single tangible asset that is separable from the rest of the firm or, alternatively, is the whole firm.

Let CF_1 and DV_1 represent random variables describing the distribution of cash flow and deprival value at time 1, given the information available at time 0. Let $CF_1{}^*$ and $DV_1{}^*$ represent the realised cash flow and deprival value at time 1. Define a single-period, ex post, deprival value accounting rate of return, α, based on a comprehensive income concept, by

$$\alpha = (CF_1{}^* + DV_1{}^* - DV_0)/DV_0 \qquad (13)$$

where DV_0 and DV_1 are the deprival values of the asset at times 0 and 1 respectively. Then Appendix 2 shows that

$$DV_0(\alpha - \rho)/(1+\rho) = [(PV_0 - OW_0) - DV_0] + \varepsilon \qquad (14)$$

where ε represents the discounted sum, at rate ρ, of the sum of the differences between expected (as at time 0) and actual cash flow and deprival value and, therefore,

$$\varepsilon = [CF_1{}^* - E(CF_1) + DV_1{}^* - E(DV_1)]/(1+\rho) \qquad (15)$$

and

$$\rho = (PV_0/(PV_0 - OW_0))\rho_{PV} - (OW_0/(PV_0 - OW_0))\rho_{OW} \qquad (16)$$

with ρ_{PV} and ρ_{OW} representing the equilibrium expected returns from holding the asset (PV) and the timing option (OW) respectively from time 0 to time 1, and PV_0 and OW_0 the present value of the asset and the value of the timing option respectively at time 0. ρ is therefore a value weighted average of ρ_{PV} and ρ_{OW}. Equation (14) forms the basis of subsequent analysis.

First, note that, in the current context of identifying monopoly rents, it seems sensible to further assume that $(PV_0\text{-}OW_0) > NRV_0$. Specifically, if this relationship does not hold, a rational firm would dispose of the asset at time 0 and no α would exist. If this assumption is made, it guarantees that $(PV_0\text{-}OW_0) \geq DV_0$ and, hence, DV_0 can either be $(PV_0\text{-}OW_0)$ or RC_0. Also, given the possible values for DV_0, it seems reasonable to assert that $DV_0 > 0$. Second, note that the sign of the left hand side of equation (14) is identical to the sign of $(\alpha\text{-}\rho)$. Third, observe that, because of the uncertainty term, ε, it is impossible to draw hard and fast conclusions about the implications of the sign of $(\alpha - \rho)$ for the existence of monopoly rents.

Nonetheless, some insights that are, in fact, qualitatively similar to those in Edwards, Kay and Mayer (1987), can be drawn. These are presented in Table 3 in terms of combinations of signs and sizes of $(\alpha\text{-}\rho)$ and ε, together with their implications, if any, for whether or not $(PV_0\text{-}OW_0) > DV_0$.[9] Observe, however, that some combinations

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[8] This is not to imply, however, that all options to wait do not give rise to monopoly profits if they are acquired via a process of competing with other firms for their acquisition. Obviously, competition can be imperfect in this context as elsewhere. The key point is that options to wait *could* be acquired via a perfectly competitive process.

[9] Private correspondence with Martin Graham of the UK Office of Fair Trading suggests that a common practice there is to use the work of Edwards, Kay and Mayer (1987) to justify using replacement cost valuations for opening and closing capital on the assumption that PV > RC at each point in time. With deprival value defined as above, the use of replacement cost requires the assumption that PV-OW > RC. As mentioned in the previous section of the paper, it is quite possible that PV > RC at the same time as PV-OW < RC. In other words, the asset represents an opportunity that has a positive net present value which does not exceed the value of the option to wait. Hence, if lost, it would not be immediately reacquired.

Table 3
Inter-relationships between α, ρ, ε and monopoly rents

Circumstance	*Is $(PV_0\text{-}OW_0) > RC_0$?*
$\alpha > \rho$; $\varepsilon > 0$	Cannot tell
$\alpha > \rho$; $\varepsilon = 0$	Yes
$\alpha > \rho$; $\varepsilon < 0$	Yes
$\alpha = \rho$; $\varepsilon = 0$	No
$\alpha = \rho$; $\varepsilon < 0$	Yes
$\alpha < \rho$; $\varepsilon < 0$	Cannot tell

are not possible given the relationship expressed in equation (13). In particular, it is not possible to have jointly $\alpha = \rho$ and $\varepsilon > 0$, nor is it possible to have $\alpha < \rho$ and $\varepsilon \geq 0$.

As Table 3 shows, unequivocal conclusions can be drawn from certain combinations of α, ρ and ε. Where unequivocal conclusions are impossible, it arises from circumstances where the effects of belief revision on the performance measure are the same as those from abnormal performance (as in the first and last cases in Table 3). Here, luck and performance effects are difficult to separate.

Further, given the contents of Table 3, it is useful to echo the words of Edwards, Kay and Mayer (1987), who argue that seeking ways of removing the influence of ε on the message sent by the sign of $(\alpha\text{-}\rho)$ would be useful. They suggest two ways of doing this. First, examine the persistence of the sign of $(\alpha\text{-}\rho)$. For example, the more years it is positive the less likely it is to be caused by expectations being more than realised each year, and the more likely it is to be caused by the existence of monopoly rents. Second, examine excess stock market returns, as they might well provide a useful indication of the sign of ε.[10]

Nonetheless, a serious difficulty with the interpretation of α now exists that does not feature in the Edwards, Kay and Mayer (1987) analysis. This difficulty lies in the benchmark, ρ, against which α is compared. Note from equations (14) and (16) that this benchmark is not the single-period, expected return on holding the asset, but rather is a weighted average of this return and the single-period, expected return on holding the timing option. Notwithstanding any difficulties that might arise in estimating ρ_{PV} and ρ_{OW}, to calculate the weights requires a knowledge of the value of PV_0 and OW_0. If such knowledge were available, it would suffice to ask companies to report replacement cost valuations in their balance sheets and then explicit comparisons of $(PV_0\text{-}OW_0)$ with RC_0 could be made without going to the trouble of using the more complex deprival valuations.[11]

5. Conclusion

Section 2 of this paper develops DV rules of asset measurement when the asset under consideration is characterised as possessing a degree of irreversibility, flexibility over when to reacquire should the firm be deprived of it, and uncertainty surrounding

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The impact on accounting rates of return if RC is used when RC > PV-OW will depend on whether this relationship occurs at the beginning of the year, end of the year, or both. The constructed accounting rate of return will not *necessarily* be a conservative estimate of α, however. As a consequence, the use of RC as a proxy for DV in constructing accounting rates of return does not rest on strong foundations.

[10] Note, however, that excess stock returns will only capture the gains to stockholders and not to other providers of finance. Because a concern with monopoly rents can be concerned with the return to the asset and not to the individual financiers of the asset, an implicit assumption of this approach is that excess returns to the other providers of finance are immaterial or substantially and positively correlated with excess stock returns.

Further, it is not clear that, even if excess returns to shareholders are a good proxy for excess returns on the asset irrespective of who financed it, such excess returns are conceptually the same thing as the difference, discounted or not, between actual and expected cash flows and deprival value. For example, DV is a composite valuation measure which reflects RC, PV, OW and NRV for the asset. Stock market valuations can be expected to reflect not only PV, OW and NRV (that is, reflect whether the asset should be disposed of) but also the value of any opportunities to add to the asset (that is, timing options). As a consequence, excess returns will reflect some stock market valuation factors that are not reflected in DV, and some factors reflected in DV will not be directly reflected in stock market valuations.

[11] This issue might be overly sophisticated, however. Given that all measures of performance have difficulties of interpretability, perhaps the most important issue is one of how the measures of performance, and their perceived deficiencies, compare with one another. Further, note that all of the above discussion assumes that mechanisms exist (e.g. auditing or pressure from managerial labour markets) to ensure that deprival valuations are provided honestly. If such is not the case, it is not clear that firms making monopoly rents would truthfully provide information that helped to reveal that fact. Finally, it is worth re-emphasising that this analysis has assumed away the practical difficulty of aggregation for DV measurements by assuming that the analysis is concerned with an economically separable asset. As a consequence, it can be seen as being concerned with an ideal case for the use of DV asset valuations. It is not clear that relaxing the assumption of economic separability would strengthen the arguments for the employment of DV to counteract the rather negative argument advanced here.

the future benefits and costs associated with the asset. These rules differ from the conventional rules in that, wherever present value appears in the conventional rules, present value less the value of the option to reinvest in the asset appears in the rules developed above. Section 3 provides a worked example that suggests the impact of using the 'conventional' DV rules in circumstances when the application of 'new' DV is appropriate can be material. The use of 'new' DV could have material implications for the application of deprival valuations in contexts such as the initial consolidation on the event of a successful takeover of an acquiree firm's assets into the acquirer firm's balance sheet, as well as the use of deprival valuations by firms attempting to comply with IAS 15.

Section 4 suggests that although accounting rates of return using the new DV rules for capital valuation as a means of detecting monopoly profits fall out rather naturally from an analysis of the circumstances when monopoly profits are expected to exist, the benchmark against which such rates of return should be evaluated needs information for its construction. If that was available and if firms were merely asked to reveal RC data, it would reveal the existence of monopoly profits directly and render superfluous the need for accounting rates of return for the purposes of such detection.[12]

One aspect of the use of DV rules that has not been referred to in the analysis above is its use in financial reporting in general. As noted in the Introduction, FRS7 (1994) and the recent discussion papers issued by the Accounting Standards Board on *Impairment of Tangible Fixed Assets* and *Measurement of Tangible Fixed Assets* (ASB, 1996a/b) advocate the use of 'conventional' DV rules under the title of 'fair value' (FRS7, 1994) and 'value to the business' (ASB, 1996b). This paper's analysis suggests that 'conventional' DV is still, to requote Whittington (1983), '...a practical technique in search of a theoretical justification'. Nonetheless, it is not clear that the 'new' DV rules developed in this paper are suitable for general use in financial reporting, if only because it is difficult to see (PV-OW) as one component of the recoverable amount of a separable tangible asset—PV still appears to be the natural measure of valuation here. One possibility might be to value at 'new' DV plus OW.[13] Such possibilities, however, are an area for future research.

Appendix 1

Proof of mathematical statements in Section 3

An asset generates a cash flow stream, C(t), described by the following process:

$$dC = \alpha C dt + \sigma C dz - C dq$$

where dz is the normal increment of a Gauss-Wiener process and dq is a Poisson jump process with the characteristic that:

$$\begin{aligned} dq &= 0 \text{ with probability } 1 - \lambda dt \\ &= 1 \text{ with probability } \lambda dt \end{aligned}$$

The cost of acquiring the project at any time is 1. Once acquired, the project can be abandoned at any time with abandonment proceeds equal to s ($1 \geq s$). The risk-free rate of return is r.

Given this description of the characteristics of the opportunity faced by the firm, the optimal investment and abandonment policy must be derived. Because, other than through reasons of the Poisson event occurring, the project is infinite lived, this reduces to finding two cash flow levels C_I and C_A, such that, if the opportunity is not held, investment will take place when C rises up to C_I and, if the opportunity is held, abandonment will take place if C drops down to C_A.

Let PV be the present value of the project. Let OW be the value of the option to invest in the project. Both PV and OW are functions of C. $PV_C = dPV/dC$, etc. If the Poisson event occurs and C drops to 0, the value of the project also drops to 0 (PV = 0 if C = 0). Again, if the Poisson event occurs and C drops to 0, the value of the option to invest in the project drops to 0 (OW = 0 if C = 0).

Conventional contingent claims is used to value PV and OW, as illustrated in, for example, Dixit and Pindyck (1994). First, assume that there is an asset X which pays no dividends and whose price process is described by:

$$dX = \mu X dt + \sigma X dz$$

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[12] This paper has said little about the practical applicability of the DV rules developed herein. This is not to say that the issue of practicability is unimportant. Indeed, one might judge that the DV rules developed are rather more difficult to apply in practice than those used conventionally, if only because of increased information requirements. Nonetheless, this paper's analysis has proceeded on the basis that the measurement of RC, PV, OW and NRV is possible and suggests that the demand for DV accounting rates of return as a means of evaluating monopoly profits is not clearcut under these circumstances. It is not clear why moving from a full information environment to one in which measurement difficulties exist would render this conclusion invalid. Private correspondence with Martin Graham of the UK Office of Fair Trading suggests that they use replacement cost valuations because deprival valuations of the type employed in Edwards, Kay and Mayer (1987) are regarded as impractical. The complications in measuring deprival value of the type introduced in this paper are hardly likely to make deprival valuations more implementable, either internally to the firm or by an external analyst.

[13] Thus, this system would value an asset at (RC+OW) when previously it would have been valued at RC, at PV when previously it would have been valued at (PV-OW), and (NRV+OW) when previously it would have been valued at NRV.

The price changes of this asset, therefore, are perfectly correlated with the component of uncertainty induced by the Gauss-Wiener element of uncertainty in the stochastic process generating the opportunity's cash flow. μ, the expected rate of return on X, is given by the CAPM:

$$\mu = r + \phi \rho_{xm} \sigma$$

where ρ_{xm} is the correlation between the return on X and the market portfolio. Assume that dz and dq are independent and that dq is a source of unsystematic risk (i.e., can be diversified away).

Consider holding the project and selling short n shares in X. The value of this portfolio is:

$$PV - nX$$

The total cash return on the portfolio in the period [t, t+dt] is:

$$Cdt + dPV - ndX$$

By Ito's Lemma, dPV is given by

$$dPV = [\alpha CPV_c + \sigma^2 C^2 PV_{cc}/2]dt + \sigma CPV_c dz - CPV_c dq$$

Therefore, the total cash return on the portfolio is given by:

$$Cdt + [\alpha CPV_c + \sigma^2 C^2 PV_{cc}/2 - n\mu X]dt + [\sigma CPV_c - n\sigma X]dz - CPV_c dq$$

Choose n to eliminate the systematic risk in this return. Therefore, let n = CPV_c/X. The total cash return becomes:

$$Cdt + [\alpha CPV_c + \sigma^2 C^2 PV_{cc}/2 - \mu CPV_c]dt - CPV_c dq$$

Dixit and Pindyck (1994) prove that $E(CPV_c dq) = \lambda PVdt$. Therefore, the expected total cash return on the portfolio is:

$$Cdt + [\alpha CPV_c + \sigma^2 C^2 PV_{cc}/2 - \mu CPV_c]dt - \lambda PVdt$$

Because the portfolio is free of systematic risk, its expected return is r. Therefore, using the derived value of n,

$$r[V - CPV_c]dt = Cdt + [\alpha CPV_c + \sigma^2 C^2 PV_{cc}/2 - \mu CPV_c]dt - \lambda PVdt$$

which reduces to the following differential equation:

$$-C = -PV(r + \lambda) - CPV_c(\mu - r - \alpha) + \sigma^2 C^2 PV_{cc}/2 \quad \text{(A1)}$$

Equation (A1) has a general form of solution: PV = AC^β. Inserting this into (A1) (and ignoring the C term) gives:

$$\sigma^2 \beta^2/2 + (r - \mu + \alpha - \sigma^2/2)\beta - (r + \lambda) = 0$$

the solutions of which are:

$$\beta = [.5 - ((r - \mu + \alpha)/\sigma^2)] \pm [[.5 - ((r - \mu + \alpha)/\sigma^2)]^2 + [2(r + \lambda)/\sigma^2]]^{.5}$$

Let the solutions be π (> 1) and θ (< 0).

A particular solution of (A1) also exists. Note that PV = $C/(\mu + \lambda - \alpha)$ solves the differential equation. Therefore, PV has the form:

$$PV = A_1 C^\pi + A_2 C^\theta + C/(\mu + \lambda - \alpha)$$

In looking at the expression for the value of the project, note that $C/(\mu + \lambda - \alpha)$ is the present value of future cash flows growing at a rate α subject to a life expectancy defined by a Poisson jump process with probability λ. Also observe that μ is the appropriate cost of capital to be applied to the cash flow stream. Therefore, $A_1 C^\pi + A_2 C^\theta$ is the value of the abandonment option.

Applying the boundary condition that the value of the abandonment option must tend to 0 as C tends to ∞, it must be the case that $A_1 = 0$. Therefore, dropping subscripts on A, the solution reduces to:

$$PV = AC^\theta + C/(\mu + \lambda - \alpha)$$

Now turn attention to the value of the option to wait, OW. Using similar methods to above

$$OW = B_1 C^\pi + B_2 C^\theta$$

Remember that OW = 0 when C = 0. As a consequence, the solution must reduce to:

$$OW = BC^\pi$$

Given the general expressions for PV and OW, impose the following boundary conditions. First, require that the difference between the benefits of investing at C_I and the cost is just equal to the option to invest foregone:

$$OW = PV - 1, \text{ when } C = C_I$$

Second, require that when the project is abandoned, the value of the option to invest reacquired plus the abandonment proceeds just equals the value of the project lost:

$$OW = PV - s, \text{ when } C = C_A$$

The remaining conditions are the so-called 'smooth pasting' conditions that require that:

$$OW_c = PV_c, \text{ when } C = C_I$$

and

$$OW_c = PV_c, \text{ when } C = C_A$$

Using the derived expressions for PV and OW leads to the following equations. These are:

$$B(C_I)^{\pi} = A(C_I)^{\theta} + C_I/(\mu + \lambda - \alpha) - 1$$
$$B(C_A)^{\pi} = A(C_A)^{\theta} + C_A/(\mu + \lambda - \alpha) - s$$
$$B\pi(C_I)^{\pi - 1} = A\theta(C_I)^{\theta - 1} + 1/(\mu + \lambda - \alpha)$$
$$B\pi(C_A)^{\pi - 1} = A\theta(C_A)^{\theta - 1} + 1/(\mu + \lambda - \alpha)$$

Therefore, four equations are available in the four unknowns—A, B, C_I and C_A. These can be solved using numerical methods to give values of PV and OW for specific values of C.

Appendix 2

Derivation of a deprival value accounting rate of return capable of providing inferences about monopoly profits

Define analytic expressions for PV and OW for the asset. Adding the subscripts 0 and 1 to represent the beginning and end of the period respectively, the expression for PV_0 is as follows:

$$PV_0 \equiv [E(CF_1) + E(MAX(PV_1, NRV_1 + OW_1))]/(1 + \rho_{PV}) \quad (A1)$$

where ρ_{PV} is the appropriate single-period, expected return on holding PV_0, CF_1 is the uncertain cash flow to be received and E(.) is the expected value operator. Essentially, the current present value is the discounted sum of the end-of-period cash flow plus the higher of (i) end-of-period present value; or (ii) the sum of end-of-period net realisable value and the value of the timing option. Hence, current present value builds in optimal disinvesting behaviour at the end of the period.[14] Rearranging equation (A1), using the observation that subtracting PV_1 from both arguments of the MAX(.) operator in equation (A1) gives $MAX(PV_1, NRV_1+OW_1) = OW+(PV_1-OW_1) + MAX(NRV_1-(PV_1-OW_1),0)$ and then applying the E(.) operator, produces

$$PV_0(1 + \rho_{PV}) = E(CF_1) + E(OW_1) + E(PV_1 - OW_1) + E(MAX(NRV_1 - (PV_1 - OW_1), 0)) \quad (A2)$$

The expression for the value of the timing option at the beginning of the period is:

$$OW_0 \equiv [E(MAX(PV_1 - RC_1, OW_1))]/(1 + \rho_{OW}) \quad (A3)$$

where ρ_{OW} is the appropriate single-period, expected return on holding the timing option. These payoffs depend upon whether the investment timing option is exercised or not, where exercise occurs if $PV_1-RC_1 > OW_1$. Rearranging equation (A3) by observing that $MAX(PV_1-RC_1, OW_1) = OW_1+MAX((PV_1-OW_1)-RC_1, 0)$ and applying the expectations operator gives

$$OW_0(1 + \rho_{OW}) = E(OW_1) + E(MAX((PV_1 - OW_1) - RC_1, 0)) \quad (A4)$$

Subtracting equation (A4) from equation (A2) gives

$$\begin{aligned} PV_0(1 + \rho_{PV}) - OW_0(1 + \rho_{OW}) &= E(CF_1) + [E(PV_1 - OW_1) \\ &\quad + E(MAX(NRV_1 - (PV_1 - OW_1), 0)) \\ &\quad - E(MAX((PV_1 - OW_1) - RC_1, 0))] \quad (A5) \end{aligned}$$

Careful inspection of the term in square brackets on the right hand side of equation (A5) reveals that this is nothing other than $E(DV_1)$.[15] Therefore, equation (A5) simplifies to

$$PV_0(1 + \rho_{PV}) - OW_0(1 + \rho_{OW}) = E(CF_1) + E(DV_1)$$

which in turn simplifies to

$$PV_0 - OW_0 = [E(CF_1) + E(DV_1)]/(1 + \rho) \quad (A6)$$

where

$$\rho = (PV_0/(PV_0 - OW_0))\rho_{PV} - (OW_0/(PV_0 - OW_0))\rho_{OW} \quad (A7)$$

Now let CF_1^* and DV_1^* represent the realised cash flow and deprival value at the end of the period. Define ε to represent the discounted sum, at rate ρ, of the sum of the differences between expected and actual cash flow and deprival value. Therefore,

$$\varepsilon = [CF_1^* - E(CF_1) + DV_1^* - E(DV_1)]/(1 + \rho) \quad (A8)$$

Finally, define a single-period, ex post, deprival value accounting rate of return, α, based on a comprehensive income concept, by

$$\alpha = (CF_1^* + DV_1^* - DV_0)/DV_0 \quad (A9)$$

With suitable rearrangements from equations (A6), (A8) and (A9), it can be deduced that

$$DV_0(\alpha - \rho)/(1 + \rho) = [(PV_0 - OW_0) - DV_0] + \varepsilon \quad (A10)$$

This is equation (14) in the text.

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[14] Also, it is important to recognise that PV_1 takes into account all abandonment possibilities subsequent to time 1. As a consequence, so does PV_0 relative to time 0. Therefore, what is being modelled here is a situation in which abandonment is considered sequentially, *one period at a time*. There is no implication that the only opportunity to abandon, should investment take place at time 0, is at time 1.

[15] The assumption that it cannot be the case that NRV > (PV-OW) > RC is needed to ensure that 'new' DV can be expressed as (PV-OW)+MAX(NRV-(PV-OW), 0)-MAX((PV-OW)-RC, 0)).

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Comparative Classical and Bayesian Interpretations of Statistical Compliance Tests in Auditing

D. J. Johnstone*

Abstract—Within the theory of statistics there are three main schools. The two longest established are based on the works of Fisher and of Neyman and Pearson, these often being loosely grouped together under the heading 'classical' statistics. The third and oldest in terms of historical development rather than broad acceptance is the school of 'non-classical' or, more precisely, Bayesian statistics. The philosophical and methodological structures of these three distinct brands of statistical thinking have some points of intersection but ultimately differ from one another irreconcilably. In practical terms, this divergence leads to incompatible and, in some cases, diametrically opposite inferential outcomes, at the level of substance and not merely form, all on the same data. In auditing, such inconsistencies can be shown, for example, in the case of a standard statistical compliance test (attribute sampling) of the test prescribed in nearly all audit sampling textbooks. From the outset, auditors have interpreted this kind of test in the way proposed and popularised by Neyman and Pearson. On comparing the Neyman-Pearson standpoint with its Fisherian and Bayesian alternatives, only the Bayesian view is seen to withstand logical criticism.

1. Introduction

When accounting researchers evaluate their own effectiveness by assessing the contribution of research to accounting practice, the theory of statistical sampling in auditing is seen as a 'success story':

> 'Statistical sampling provides a natural starting point for our survey of academic auditing research. Since much of the statistical research has been encouraged, supported and adopted by real-world auditing firms, it provides an important illustration of auditors' interest in efficiency....And the techniques are of interest in their own right. They have occupied much of the academic literature and, for those who believe that academic disciplines have something to contribute to auditing, constitute a real success story' (Scott 1984a:154–5).

Further to such praise, the interaction of researchers and practitioners in the historical development of audit sampling theory is held out as a model for future joint ventures:

> 'The development of the use of audit sampling in practice over the last 30 years clearly illustrates productive collaborations among practitioners and academicians from both auditing and statistics. These relationships allowed researchers and policy makers to share knowledge about the field of statistical sampling and ways of applying sampling to auditing. In addition, much of the impetus for the development of policies and methods for non-statistical sampling in auditing derived from these efforts. The result has been the successful development and communication of methods, policies (for firms and for the profession as a whole), and educational materials and practices throughout the profession, both in the United States and abroad....Our overall conclusion from analysing this history is that the process that occurred provides a healthy and productive model for the profession's development' (Aldersley et al., 1995: 86)

Any apparent self-satisfaction among those responsible for the development of statistical sampling in auditing is to a large extent justified. Indeed there has been praise from statisticians in regard to the level of technical development of audit sampling, and in some ways statistical sampling in auditing has added to, rather than merely drawn upon, the technical knowledge of statistics (Birn-

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*The author is at the University of Wollongong. Correspondence should be addressed to Professor D. J. Johnstone, Department of Accounting and Finance, University of Wollongong, PO Box 1144, Wollongong NSW 2522, Australia. E-mail: d.johnstone@uow.edu.au. This article was first submitted in August 1996 and finally accepted in July 1997.

baum et al., 1989).[1] However, in contrast with its level of technical advancement, the theory of statistical sampling in auditing is not highly developed philosophically.

In the discipline of statistics proper, and also in the philosophy of science, there is a longstanding, extensive and precisely articulated literature on the logical foundations of statistical inference (evidence) and decision-making. One of the main threads of this literature is its comparison of the outcomes and logical interpretations of conventional or 'classical' statistical methods and their Bayesian counterparts. The importance afforded by statisticians to critical comparative study of classical and Bayesian methodologies is evident not merely in the extent and seriousness of debate but also in the involvement of nearly all the most highly reputed statistical theorists of the century, beginning with Fisher, Neyman and Pearson.

The force of debate in statistics over fundamental philosophical and logical principles has registered and been amplified in most branches of applied statistics. For example, in econometrics, researchers such as Zellner (1984: 276–9) and Judge et al. (1982: 101) have made much of the weaknesses of classical hypothesis tests by comparison with alternative Bayesian methods, and a whole field of Bayesian econometrics has been spawned. The same cannot be said, however, of statistical auditing. Indeed the discipline of statistical sampling in auditing is remarkable for its virtual neglect of the dispute in statistics over philosophical foundations. There are certainly publications in statistical auditing that take a purely Bayesian technical approach (e.g. Felix and Grimlund, 1977; Cox and Snell, 1979; Steele, 1992; Van Batenburg et al., 1994) but there has been little discussion or even acknowledgment among the audit sampling research community of the fundamental issues of logic which divide classical and Bayesian statistics. This is despite these issues having been given so much import in statistics and other applied fields such as econometrics.

In effect, whether by majority intention or otherwise, the deep concern in statistics over foundations has been suppressed. Moreover, rather than researchers in auditing having opened up to the debate and profound disparity between the classical and Bayesian paradigms, either in general or in relation to the issues as they arise in auditing applications, there is instead an often latent but generally agreed notion that when auditors practise classical statistical methods they do so in some way which qualifies them also as Bayesian.

Such faith in the consistency of classical sampling methods with the Bayesian framework is at least partly attributable to influential papers by Kinney (1975a; 1975b). Here Kinney develops an ostensibly Bayesian decision theoretic model of auditing. According to this model, an auditor can condition the probability of the hypothesis *H* being tested on the outcome ('accept *H*' or 'reject *H*') of a classical Neyman-Pearson hypothesis test, and thus come to a Bayesian inference while still using a classical test. This is simplistic if not simply wrong (see herein), and is also manifestly at odds with the very substantive efforts of researchers in statistics towards a reconciliation or bridge between classical and Bayesian statistics.

Unfortunately, Kinney's model has served to reassure auditors that a practitioner using only classical statistical tests can emulate Bayesian decision models merely by making reference, either formal or informal, to prior probability distributions and appropriate loss functions when setting the Type I and Type II error probabilities of their 'classical' (Neyman-Pearson) tests.

Furthermore, and just as much a product of auditing's neglect of the most fundamental logical issues separating Bayesian and classical methodologies, authors in auditing continue to make embarrassingly basic errors of logic, particularly in their confusion between classical and Bayesian concepts and measures. Typically, for example, classical confidence levels and error probabilities, which in general cannot be viewed validly other than as long-run error frequencies, are interpreted as if they represented Bayesian degrees of inductive belief (e.g. Aldersley et al., 1995: 94; Guy et al., 1994: 51, 70; Arens and Loebeckke, 1981: 72, 130, 133–4). This is in the face of repeated reproof from both classical and Bayesian statisticians (cf. Berger and Sellke, 1987: 114).

On occasion, the documented logical errors of auditors extend beyond sloppiness and methodological naivety. For instance, an unthinkable error of logical and mathematical interpretation occurs in the current and authoritative text Guy et al. (1994: 50). This error, detailed herein, renders the authors' exposition of a statistical compliance test technically incomprehensible to any reader other than someone already trained and versed in such mistakes. Somewhat less astonishing errors of logic and interpretation are very common in the audit sampling literature. A characteristic, although atypically explicit, example arises in Kinney and Uecker (1977) and is perpetuated in Guy et al. (1994: 80) and its solutions manual. Details are contained in Johnstone (1997).

In the continued presence of such logical inaccuracies and basic misconceptions, it is difficult to fully agree that audit sampling, and its collaboration between theorists and practitioners, should be seen idealistically as a model for other productive accounting research. To the contrary, it is perhaps fair to speculate that the undoubted importance of practitioners and fee-earning practice in this development has acted to suppress consideration of fundamental issues, such as might have disturbed the confidence placed by audit firms in the defensibility before clients and courts of their newly adopted statistical methods.

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[1] Auditing requires probability models allowing for very low error rates and skewed populations not typical of other applied fields.

The object of this paper is to prompt statistical auditing into catching up with its parent discipline statistics and other applied disciplines in their consideration of philosophical and logical foundations, at least as applicable to auditing. Until auditing researchers and practitioners are made properly familiar with the foundational issues which pure and applied statisticians treat as of such concern, statistical auditing will not in any way reflect the maturity and methodological sophistication of statistics proper.

In practical terms, this will mean more than just the perpetuation in print of errors of logic and interpretation. At a 'whole of discipline' level, such errors are possibly excusable as merely individual slips rather than as representative of a pervasive disciplinary weakpoint.

Less easily dismissed, however, is the thought that in discounting rather than broaching the most basic logical and philosophical issues (e.g. what does the result of a statistical test or interval estimate convey in terms of evidence?), auditors will be less able to defend or even speak for themselves against better versed statisticians. This must be of concern given the potential for litigation. At a more everyday level, any apprehension felt by auditors over their reliance on subtle and potentially questionable methods of statistics can only retard the extent to which statistical tools are used, and thereby diminish the total capability and effectiveness of the profession.

2. Why consider Bayesian statistics?

The various statistical methods relied on by auditors are mostly classical rather than Bayesian, but this should not be seen as precluding Bayesian statistics from substantially influencing statistical practice in auditing. Classical statistical methods are not easy to understand other than in a technical way. The difficulty is not one of following appropriate mathematical routines and calculating sample outcomes, but of *interpreting* those outcomes in ways which are valid conceptually (logically) and at the same time practically meaningful. Auditors and others who rely to any extent on the results of classical procedures, have much to gain from examination of how classical results can be interpreted Bayesianly. This is especially true of hypothesis tests, procedures which have long been part of auditing applications, in, for example, compliance testing (attributes sampling) and statistical tests of details (variables sampling[2]).

When it comes to interpreting, as distinct from merely generating or reporting test results, the textbook literature in classical statistics, both in statistics proper and in applied fields such as auditing, is on the whole confusing and confused. Remarks to this effect are commonplace in the critical literature on statistics, as might be expected, but also arise within mainstream theoretical statistics among even the most authoritative and supportive advocates of the classical framework:

> '...tests of significance are either ignored or mishandled in practically all statistics textbooks, and careful consideration of the logical principles involved is urgently needed' (Kalbfleisch and Sprott, 1976: 259).

> 'A pressing issue in terms of general ideas on technique is to come to some agreement about the nature, purposes and limitations of significance tests, or their Bayesian analogues, and to adjust teaching at all levels. There is almost certainly no single topic so misunderstood...' (Cox 1981: 292).[3]

Moreover, there is a view among many statistical theorists that it is the methods themselves, rather than merely their depictions in textbooks, which are illogical and in need of review (e.g. Berger and Delampady, 1987: 319; Berger and Sellke, 1987: 135–6; Pratt et al., 1995: 517–549). Underlying these alleged deficiencies is in fact a long history of intense and sometimes personally acrimonious intellectual infighting within the classical school in statistics.

The first and worst offenders were the factional leaders R.A. Fisher and J. Neyman, to one or other of whom nearly all the classical framework and methods are due. The issues on which these two disagreed, and argued bitterly for over 50 years, were mostly to do with the interpretation of hypothesis tests (this is Neyman's term; Fisher called these significance tests).

This argument has never been resolved within the classical (non-Bayesian) camp, as is evident in the ways different authors say different things, and, more so perhaps, in the way the same authors sometimes say different things, on the matter of how results should be interpreted. Examples of these inconsistencies are readily apparent (cf. Johnstone, 1995: 171; also below) and will be known to those who have cross-examined even a few statistical reference books either in auditing or statistics.

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[2] Although not always recognised as such, most applications of dollar unit sampling in auditing are in essence just a variety of classical statistics (the exception is Bayesian DUS; e.g. Cox and Snell 1979).

[3] D.R. (Sir David) Cox is no Bayesian, contrary to the impression created by Cox and Snell (1979); it is something of a statisticians' joke that auditors have gained this impression (Andrews and Smith, 1983).

The disagreements and disharmony within classical statistics on issues of interpretation make the insights emanating from the Bayesian perspective all the more welcome. Study of Bayesian literature on hypothesis tests and related matters provides grounds on which to adjudicate over classical infighting, and leaves even those who remain committed to a classical view with a deeper appreciation of the meaning and weaknesses of classical test outcomes. Notwithstanding the documented deficiencies of classical tests, there persists quite general support for the Neyman-Pearson and Fisherian paradigms. This is partly because the shortcomings and infirmities of these frameworks are not widely known or understood, but also because rival paradigms have their own inherent difficulties, if not in their logic then in their application.

This was the point of Dacey and Ward (1984) in reference to Bayesian statistical methods (see below). For whatever reasons, some to do with the sociology of statistical theory and practice (cf. Oakes, 1986: 68–72), classical hypothesis tests remain standard if not axiomatic practice in many areas of research and applied statistics. Whether or not this is to change,[4] the added methodological sophistication available to users of classical tests upon consideration of the Bayesian argument is considerable, and sufficient to warrant the interest of all practitioners, including those who have only ever been instructed and thought in terms of classical statistics.

3. Recent background to this study

Akresh et al. (1988: 50) identified the need in auditing for comparison of Bayesian and classical statistical methods in matters affecting important practicalities, including, specifically, requisite sample sizes, articulation (aggregation) of sample evidence with the wider audit, and defensibility on methodological and other grounds. At the time of publication of the Akresh et al. (1988) research agenda, the only paper in auditing dedicated to a critical comparison of classical, Bayesian and other statistical foundations was that of Dacey and Ward (1984). Indeed, apart from this paper, there had been little if any discussion in auditing literature of the alleged (by Bayesians and others) profound inadequacies of Neyman-Pearson based hypothesis tests and confidence intervals, nor of the fundamental, philosophical and logical differences between these methods and those of the rival, Bayesian school.

While not supporting the Bayesian approach, Dacey and Ward (1984) raised foundational questions concerning the applicability of classical methods in auditing, bringing to light issues that were well documented in the critical, particularly Bayesian, literature in statistics, but which had previously escaped auditing practitioners' and theorists' attention.

During the period since publication of Dacey and Ward (1984), the auditing profession's reliance on statistical sampling has apparently diminished (Aldersley, 1994; Loebbecke, 1995: 189; Aldersley et al., 1995: 96), although what effect that paper had on practitioners is hard to judge; other factors such as sampling costs and increased competition having certainly been more influential. In these altered circumstances, the foundational issues raised by Dacey and Ward (1984) and mooted for further research by Akresh et al. (1988) were re-examined recently in Johnstone (1995) and Edwards (1995).

Commenting on these papers, Loebbecke (1995, p.189) took the view that where classical methods have inherent weaknesses by comparison with their Bayesian alternatives, their supposed relatively infrequent application can be cited in their defence, particularly given the very large transaction costs (research, software, training, legal precedent uncertainty, etc.) to the profession of any shift to non-standard, Bayesian methodology. It is recognised in Lobbecke's response, nonetheless, that so long as classical statistical methods remain among the tools used by auditors, there is an obligation on the profession to use these methods in a way which withstands logical criticism, and to this extent the Bayesian critique of Johnstone (1995) and Edwards (1995) is condoned:

> 'Not only does it appear that statistical sampling is used less in substantive tests today than in the past, where it is used, monetary unit rather than classical sampling is the predominant method. Now, does this mean that there is no problem, that Johnstone and Edwards' advice is irrelevant? No, because anytime statistical methods are used in auditing, they must be used properly. But a reduction in use does present a different view in terms of the resources the profession may expend to motivate major change' (Loebbecke, 1995: 189).

Curiously, the recently revised reference text on audit sampling of Guy et al. (1994) is written without even a mention, either express or implied, of the Bayesian arguments contra-indicating classical statistical methods and practices, nor indeed with any acknowledgment that statistical sampling is no longer relevant or applicable to the problems of auditing other than as a matter of course. This alone would seem to imply that opinion makers in the field of statistical sampling in auditing are not sensitive to Bayesian thinking, and that any argument that statistical sampling is now of lesser importance to auditors may be a 'convenience' rather than a considered response to the Bayesian critique.

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[4] Among medical research journals, including the *British Journal of Medicine* and the *American Journal of Public Health*, there is some official rejection of classical hypothesis tests in favour of confidence intervals (Gardner and Altman, 1989: 4).

Moreover, it is understandable that with changes in the auditing environment (e.g. increased competition and litigation), auditors' reliance on statistical sampling will also change, but there is nothing to preclude the possibility that this reliance will increase, particularly if the suggested deficiencies of judgmental sampling (cf. Guy et al., 1994: 206–7) were to be affirmed in the findings of courts. Whatever occurs in the future, it would seem unreasonable to maintain that classical statistical methods can be excused from scrutiny on the grounds that they are less used at present than at times in the past. It is clearly not the intention of Loebbecke (1995) to do this; to the contrary, his commentary on the Johnstone and Edwards studies prompts those with concerns to 'continue the dialogue' (p.188). This paper is written partly with that intention, and, at the same time, to clarify and extend the findings of Johnstone (1995).

4. An example test

To facilitate comparison of the Bayesian and classical standpoints on test interpretation, let us consider a textbook standard compliance test of the type described in well known statistical auditing texts including Roberts (1978: 49–57), Arens and Loebbecke (1981: 54–80), AICPA (1983: 21–40, 103–9) and Guy et al. (1994: 42–59). Take, for example, a test of controls where the maximum tolerable error rate is say $m=15\%$. In terms familiar to any classical statistician, this is simply a test of the null hypothesis

$$H_0\colon \rho \leq 0.15$$

against its complement (alternative)

$$H_1\colon \rho > 0.15,$$

where the number of deviations k in a random sample of preset size n has a binomial distribution with parameter ρ $(0 \leq \rho \leq 1)$ and index n.

The auditor's conventional decision rule (Roberts, 1978: 54; Arens and Loebbecke, 1981: 78–9; AICPA, 1983: 104; Guy et al., 1994: 53) is to 'reject H_0' if and only if the $100(1-\beta)\%$ upper confidence limit [UCL][5] for ρ exceeds $m=0.15$. This rule constitutes a 'negative' form test in the terms of Duke et al. (1982: 51), since its effect is to anchor the power function with respect to $\rho=m$ (rather than against $\rho=0$ as is the case in a 'positive' test).[6] Specifically, the power of the test against $\rho=m$, which constitutes the minimum power against H_1: $\rho>0.15$,

$$\min_{\rho>m} p(\mathit{reject}\ H_0|\rho),$$

is $100(1-\beta)\%$, where β, the maximum Type II error probability of the test, is set by the auditor at say 5%, or whatever low value is seen fit. This probability β is known in auditing as the risk of over-relying on controls. Power against other ρ values, and hence the probability of Type I error, depends on the sample size n, which is also determined by the auditor according to the circumstances.

So as to enable specific example calculations, two possible (hypothetical) test results are considered:

$$(k=1,\ n=30) \Rightarrow 95\%\ \text{UCL}=0.149$$
$$(k=9,\ n=100) \Rightarrow 95\%\ \text{UCL}=0.152.$$

On the first of these results, H_0 is formally 'accepted' since UCL$\leq$0.15, and on the second result, H_0 is 'rejected', because UCL$>$0.15. The issue must then arise as to what it means to 'accept' or 'reject' the hypothesis that the population error rate is less than or equal to m. Unless this question can be answered satisfactorily, it is hard to see how auditors can be expected to assimilate the evidence represented by their own observed test results into any overall or even partial assessment of audit evidence.

In what follows, consideration is given to interpreting such results within the strictures of Neyman-Pearson, Bayesian and Fisherian statistics. Illustrative calculations are provided based on the two example results assumed for this purpose, and also more generally in demonstration of broader points of principle.

5. Neyman-Pearson interpretation

The binomial test described above is set up in a way conventional in auditing but contrary to the formal conventions of the Neyman-Pearson (hereafter N-P) framework. Part of the protocol of N-P hypothesis testing is that when one hypothesis

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[5] Based on the sample observation $k=k_0$, the $100(1-\beta)\%$ upper confidence limit for ρ is that value ρ_u such that the probability given that $\rho=\rho_u$ of k exceeding k_0 in a sample of size n equals $100(1-\beta)\%$. (Cochran, 1977: 59–60).

[6] The distinction in auditing between 'positive' and 'negative' hypothesis tests does not occur in statistics proper and at first seems facile, since a positive test is effectively a negative test, and conversely, depending only on the chosen sample size. Substance is given to this distinction, however, by the finding of Beck and Solomon (1985) that when test assumptions (e.g. normality) are violated, so-called positive and negative tests with the same theoretical (ex ante) power functions have differing actual (ex post) power functions.

H_0 is tested against another, either can be incorrectly rejected, and of these two possible errors, the one with higher cost is to be referred to as a 'Type I' error. Furthermore, because a Type I error is defined formally as incorrect rejection of H_0 (incorrect rejection of H_1 is a Type II error), it is necessary to give the label H_0 to the hypothesis with greater cost when incorrectly rejected. The other hypothesis if falsely rejected presents lesser cost and is labelled H_1 (Neyman, 1950: 263–4).

Applying this convention to the binomial (compliance) test of $\rho \leq 0.15$ against $\rho > 0.15$, the latter rather than former should be H_0, since its rejection is the more costly or worrisome when incorrect. Contrary to the N-P convention, most expositions of hypothesis testing in auditing (both in compliance tests and tests of details) have the hypothesis that the auditor can least afford to reject incorrectly as that designated H_1. So as to compensate for this turnabout, the Type II ('beta') error is given priority over the Type I ('alpha') error. For example, in the test described above, the decision rule, which is expressed in terms of $100(1-\beta)\%$ confidence intervals, is designed so as to implicitly fix the maximum Type II error probability β at 0.05 or some similarly low value. This test configuration mirrors the usual N-P set-up, by which hypothesis tests are described in terms of $100(1-\alpha)\%$ confidence intervals, α representing the maximum Type I error probability. Apart from their unconventional labelling of hypotheses and errors, and the accordant precedence afforded to β over α, hypothesis tests in auditing are in form and mechanics essentially pure N-P.

Whether there is this same commitment among auditors to the N-P paradigm in matters of test interpretation is another issue. In their celebrated 1933 joint paper, Neyman and Pearson introduced the extreme philosophical standpoint that no statistical test involving probability calculations (which of course any mathematically-based sampling procedure must) can provide evidence in any degree for or against a particular hypothesis:

> 'We are inclined to think that as far as a particular hypothesis is concerned, no test based upon the theory of probability can by itself provide valuable evidence of the truth or falsehood of that hypothesis' (Neyman and Pearson, 1933: 141–2).

By Neyman's standards, any inductive argument leading to a conclusion such as 'H_0 is probably false' (e.g. Bayesian inference; Lindley, 1965: 61; Berger, 1985: 145–58) or that 'there is strong evidence that the null hypothesis is false' (e.g. Fisherian *P* value significance testing; Fisher, 1973: 46–7; Kempthorne and Folks, 1971: 222; Kalbfleisch, 1979: 136) is without justification. The problem, according to Neyman, with inferences such as these is that they are necessarily subjective and hence unscientific, either because they depend on subjective prior probability distributions (Bayesian inference) or on 'dogmatic' principles of reasoning which, unlike Bayes theorem, are founded only on personal intuition and are not demonstrably valid rules of logic (this criticism was meant for the Fisherian patterns of inference, including primarily *P* value or tail-area testing, but also for methods of inference using likelihood functions and Fisher's 'fiducial inference'):

> '....I must confess being unable, so to speak, to put my teeth into any concept relating to confidence or diffidence other than by considering it as dogma advanced by someone. The dogma is to the general effect that I *should* calculate a specified function and then *should* believe in this or that statement. This I am generally not willing to do' (Neyman 1963: 929–30).

For Neyman and those including Wald (1971) who extended and generalised the N-P theory of hypothesis tests into the theory of statistical decision functions, a hypothesis test is merely a decision rule, the result of which is an action, but not an action based on any implied or underlying belief or inference. Moreover, any inference or logical assessment of evidence concerning the hypothesis tested (i.e. concerning parameter ρ) is expressly denied.

> 'According to Neyman, there is no such thing as inferring the truth of a hypothesis from inconclusive data; there is only a choice of one action over others' (Giere, 1976: 66).

> 'The question whether theory and data are in agreement has, on this view, *no answer*. All that the experimenter can do is lay down a decision rule in advance which divides all outcomes into two non-overlapping zones of acceptance or rejection. An action "appropriate" for the null hypothesis is taken when the outcome falls in the acceptance zone, and an action "appropriate" on the alternate hypothesis is taken when the outcome lands in the rejection zone (or *critical region*). Thus, rather than attempt to answer the question: does the result of this skin test evidence infection?, the N-P theorist adopts a decision rule with low probabilities of misclassifying healthy patients as infected or infected patients as healthy' (Rosenkrantz, 1973: 309).

Neyman's 'act as if' recipe for interpreting the results of hypothesis tests as decisions rather than as inductive conclusions or inferences, extends also to the interpretation of confidence intervals. Indeed it is in this regard, more so even than in reference to hypothesis tests, that Neyman made clear his 'aevidential' (Johnstone, 1995: 170) decision theoretic philosophy of statistics:

> '...after observing the values of the x's in a case where the θ's are unknown and calculated θ_l and θ_u [lower and upper confidence limits], we may *decide* to behave as if we actually knew that the true value Θ of θ were between θ_l and θ_u. This is done as a result of our decision and has nothing to do with "reasoning" or "conclusion"....The above process is also devoid of "belief" concerning the value Θ of θ' (Neyman, 1941: 379–80) [NB. minor notation changes].

> '...suppose that the statistician decided to use a 95% confidence interval....Naturally, this probability $p = 0.95$...must be clearly distinguished from a probability that the true parameter value lies within the indicated limits, etc.' (Neyman, 1963: 930).

That neither the results of N-P hypothesis tests nor confidence intervals can 'officially' be interpreted in terms of evidence, support or degrees of belief concerning ρ may be surprising and disconcerting for practising auditors who routinely think of acceptance of the hypothesis that an error rate (or mis-statement in an account balance) is immaterial, as providing evidential support in favour of that hypothesis, and conversely, of rejection as evidence supporting the alternative hypothesis (cf. Kinney and Uecker, 1977; Beck and Solomon, 1985: 1; Guy et al., 1994).

In the early stages of their celebrated work on the theory of hypothesis testing, Neyman and Pearson did indeed allow an evidential interpretation of the terms 'accept' and 'reject'; in the first of their joint papers (1928: 1, 28–9, 67) they agreed with earlier writers, including Karl Pearson (E.S. Pearson's father) and Fisher, that statistical hypothesis tests were methods with which to accept or reject the null hypothesis 'with a greater or less degree of confidence'. It became evident, however, that there were insuperable logical problems in using hypothesis tests as methods for inference (see below), so much so that Neyman particularly gave up on this model, proposing in its place a theory not for statistical inference but for the more pragmatic task of statistical decision-making.[7]

In the context of a compliance test in auditing, the question N-P methods answer is not whether or not there is sample evidence that the population error rate is less than the auditor's upper acceptable limit (as stipulated in H_0), but whether or not the auditor can continue the audit on the *presumption* that indeed this is the case. Some statistical theorists, including Neyman (1971: 80), explain this interpretation by the rule that to 'accept H_0' is not to believe or act in the belief that H_0 is true, but merely to act *as if* H_0 were true, and known to be so (e.g. Lehmann, 1986: 101; Hodges and Lehmann, 1970: 311; Lindgren, 1976: 306). Such action, having no basis in evidence, is justified instead by the long-run operating characteristics (error frequencies) of the decision rule with which it is made (Johnstone, 1995: 158, 171).

Applying this mode of interpretation to the two hypothesis test results supposed above, the auditor must in the first case ($n = 30$, accept H_0) *act as if* H_0 is true, and in the second case ($n = 90$, reject H_0) *act as if* H_0 is false. The weakness in this interpretation is that auditors do not make audit decisions purely on the grounds of hypothesis test outcomes. Other evidential matters are taken into account in conjunction with hypothesis test outcomes, and indeed in some circumstances these collateral matters are weighted sufficiently to override or offset a hypothesis test 'rejection' (or to discount or negate an 'acceptance'). In the event that H_0 is rejected in a hypothesis test, the auditor will rarely be prepared to simply proceed with the audit on the presumption that H_0 is false, at least not without further investigation. This was the conclusion of Sennetti (1995):

> '...statistical decisions are not audit decisions' (Sennetti, 1995: 197).

It is because statistical decisions (e.g. 'reject H_0') are not of themselves audit decisions that decision-making in auditing does not fit the N-P mould. Guy et al. (1994: 51) were faced with this difficulty in their exposition of N-P statistical compliance tests. They averted the issue only by making the simplistic and unsustainable assumption that statistical decisions are in fact audit decisions:

> 'Reliability refers to the probability of being right in making a conclusion about the operating effectiveness of a control procedure. If an auditor selects a 95% reliability level, he or she has a 5% chance (risk) of assessing control risk too low...This assumes that the statistical evaluation and qualitative (judgment) evaluation are the same' [last sentence in footnote].

The essence of the problem that Guy et al. (1994) gloss over[8] is that the N-P framework cannot cope with being only part of the decision basis. Its whole rationale hinges on there being nothing else. Data are drawn and a decision is made strictly and simply according to whether those data fall into the acceptance or rejection region of the sample space. When next the same decision arises, the same mechanistic procedure is again applied. Repetition of this process gives rise to a real or at least imaginary 'long run' of decisions over which the average probabilities (relative frequencies) of Types I and II errors closely approximate those (maximum) values α and β inherent within the test procedure. Each decision in this sequence of repetitions is justified merely by its being one of a series of repeated trials containing on average low error frequencies (α, β). Of all the decisions comprising this series, no one decision can be justified *of itself*, or, in other words, without reference to either the whole series or, equivalently, to the frequency properties ('error characteristics') of the decision rule by which that sequence is generated. In justifying a particular decision, there can be no appeal to 'the evidence' or to what the data in that single case imply about the truth or otherwise of H_0. Indeed, according to Neyman, the very notion of statistical evidence, however explicated, is unspeakable. Rather than any evidential basis, the only available rationalisation of any particular decision is its good statistical 'pedigree'; that is, its having been generated by a procedure which over the long run produces appropriately few errors of either Type I or Type II:

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[7] Decision-making without prior inference is peculiar to the N-P (or N-P-Wald) formulation. Inference (at least implicit) is usually seen as a prerequisite to decision (e.g. Fisher, 1955: 77; Lindley, 1977: 51–2; 1965: xii). Rejecting the N-P formulation, Cox (1978: 44–5) writes: 'The notion quite widely advanced 20–25 years ago that all statistical problems should be regarded as decision ones is now not often heard.'

[8] Guy et al. (1994) are not to blame for what is an inherent weakness of the N-P formulation. Johnstone (1987b) finds that Neyman too was unable to meet the evidential needs of test

> 'Without hoping to know whether each separate hypothesis is true or false, we may search for rules to govern our behaviour with regard to them, in following which we ensure that, in the long run of experience, we shall not be too often wrong. Here, for example, would be such a "rule of behaviour": to decide whether a hypothesis, H, of a given type be rejected or not, calculate a specified character, x, of the observed facts; if $x > x_0$ reject H, if $x \leq x_0$ accept H. Such a rule tells us nothing as to whether in a particular case H is true when $x \leq x_0$ or false when $x > x_0$. But it may often be proved that if we behave according to such a rule, then in the long run we shall reject H when it is true not more, say, than once in a hundred times, and in addition we may have evidence that we shall reject H sufficiently often when it is false' (Neyman and Pearson, 1933: 142).

The error probabilities in an N-P hypothesis test attach only to a given sequence of test results, and not to any one result within that sequence (Neyman, 1971: 13). Thus, just because H_0 is accepted in a test with maximum β of say 0.10, there is no possibility of concluding that the probability of that particular acceptance being incorrect is no higher than 0.10, or, put another way, that the probability of H_0 being in fact false is no more than 0.10. This is for at least two reasons, neither of which is as widely understood as might be expected:

i) The error probability β is the probability of an acceptance given false H_0, not the probability of false H_0 (true H_1) given an acceptance. That is, β equals p (accept $H_0|H_1$) not $p(H_1|\text{accept } H_0)$. It is possible to calculate $p(H_1|\text{accept } H_0)$ from the N-P error probability $p(\text{accept } H_0|H_1)$ but only by way of Bayes' theorem and hence only after introduction of a prior probability distribution over the parameter space (see equation (2) below). Confusion of what is inherently a Bayesian probability $p(H_1|\text{accept } H_0)$ with its N-P 'look-alike' $p(\text{accept } H_0|H_1)$ is a common but serious mistake, and is frowned upon by statisticians for what it implies about users' comprehension of classical, as opposed to Bayesian, statistics.[9] The following confused quote from Guy et al. (1994), of which only the first sentence is correct, reveals how easily many test users slip from a principled N-P interpretation into an unprincipled and unjustifiable Bayesian-type interpretation of test outcomes:

> 'If the auditor decides that a 90% reliability [confidence] level is acceptable, he or she has a 10% statistical chance of concluding that the control procedure is operating effectively when it is not. In brief, the reliability level is the probability that the auditor's statistical conclusion will be correct' (Guy et al., 1994: 51).

A further and more 'objective' instance of this same confusion occurs also in the audit sampling text of Guy et al. (1994: 48–51). On the subject of attribute sampling, the authors demonstrate a compliance test of H_0: $\rho \leq 0.05$ against H_1: $\rho > 0.05$ wherein the 'risk of assessing control risk too low', $p(\text{accept } H_0|H_1)$, is set at a maximum of $\beta = 0.10$. To accept H_0 in this test, with sample size $n = 45$, the number of errors k in the sample must not exceed zero. If just one error ($k = 1$) is observed in a sample of $n = 45$, the $100(1 - \beta\%) = 90\%$ UCL for ρ equals 0.084, which is greater than 0.05 and

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applications while complying with the conceptual strictures of N-P statistics.

[9] That practitioners and indeed many applied theorists in all fields insist on interpreting classical error probabilities as the probabilities of hypotheses on data, rather than of data on hypotheses, is marked by the great number of statistical theorists who have felt obliged to comment on this misinterpretation, those critics including nearly every notable contributor to the logic of statistical tests. Just a few references are Jeffreys (1961: 80–1), Savage (1961: 3–22), Carnap (1962: 517), de Finetti (1975: 248), Good (1981: 161), Cox (1982: 329), Berger and Delampady (1987: 319), and Berger and Sellke (1987: 114).

hence H_0 is rejected. But if $k=0$, the 90% UCL for ρ is 0.05 and H_0 is accepted. Taking the example scenario in which $k=0$, Guy et al. (1985: 50) conclude as follows:

> 'Zero deviations noted; therefore, conclude that there is only a 10% risk that the actual rate of invalid sales and accounts receivable [ρ] is not more than 5%.'

What has happened here apparently is that the authors have interpreted the maximum Type II error probability $\beta = p(\text{accept } H_0|H_1) = 0.10$ of their test as the posterior probability of the hypothesis H_0: $\rho \leq 0.05$ (that the true error rate ρ is not more than 0.05) based on this hypothesis having been accepted. That is, $p(\text{accept } H_0|H_1) \leq 0.10$ is taken as implying that $\text{p}(H_0|\text{accept } H_0) = 0.10$. Apart from treating $\leq$ as $=$, there are two mistakes in this. The order of conditioning is wrong, which is a common mistake, and to make matters worse it is H_0: $\rho \leq 0.05$ rather than H_1: $\rho > 0.05$ which is made the subject of the incorrect probability statement. The only conceivable explanation for this compound error is that the word 'not' in 'not more than 5%' was unintended by the text's authors, and the more typical mistaken conditioning reversal was unrecognised.

ii) The error probability β of an N-P hypothesis test measures the (maximum) relative frequency of Type II errors over a population of test repetitions, but within that population there are almost always *identifiable subsets* exhibiting Type II error frequencies greater or less than the population average β. It can be highly inappropriate, therefore, to apply β to a particular single test outcome, when that particular outcome is seen to belong to what Fisher (e.g. 1973: 35) referred to as a 'relevant' subset (i.e. a subset over which the error frequency in question is known to differ, perhaps markedly, from the population average).

This is for the same reason as it would be inappropriate to interpret the relative frequency of lawyers in the whole of the US as the probability of one randomly selected individual being a lawyer, when, say, that particular individual is known to be a 70-year-old married female. In the case of such an individual, notwithstanding her having been selected at random from the whole US population, the population average obviously does not apply. Instead, the sample (individual) selected belongs to what is on any reasonable judgment a 'relevant' or unrepresentative subset of that whole population, thus vitiating any subjective interpretation of the overall population average as a probability applicable to the single case (lady) in question.

In a sequence of repeated hypothesis tests, just as in the population of the US, there are many relevant subsets, some being more obvious than others. An extensive literature in theoretical statistics sets forth the conditions on which test sequences contain relevant subsets (see Berger and Wolpert, 1984: 11–18 for discussion and references). Some of these conditions are intuitively obvious and others are very technical, although just as much of theoretical and practical concern. To illustrate the more intuitive intrusion of a relevant subset, imagine a random sample of purchase invoices in which all or nearly all were processed by one special employee, a person known to be assiduous in complying with control procedures. Suppose that the number of errors observed in this sample of $n=35$ invoices is zero, and accordingly the hypothesis that the population error rate does not exceed 15% is accepted upon application of a test with maximum $\beta=0.05$ (the 95% UCL is 0.083). Now does this mean that the maximum probability $p(\text{accept } H_0|H_1)$ attaching to this particular test is just $\beta=0.05$? Clearly no; in fact had the error probability $p(\text{accept } H_0|H_1)$ been measured over the subset of only those samples containing all invoices processed by this particular employee, its value would have been close to one (rather than 0.05). This is because there are nearly always zero errors in such samples, and hence, on drawing just such a sample, H_0 is nearly always accepted, no matter whether in fact H_0 (which is about the whole population) is true or false.[10]

Stratified sampling is a way of precluding a random sample from belonging to certain obvious relevant subsets; however, it is usually impossible either technically or for practical reasons (e.g. cost) to stratify against every conceivable relevant covariate. And then there are the technical or mathematical relevant subsets, such as those defined by the observed values of ancillary statistics, which cannot be stratified away. In some tests, there are multiple ancillaries, meaning that the logical and technical problems of identifying the appropriate ('most relevant') relevant subset and measuring the required error frequency over that subset become intractable (Berger and Wolpert, 1984: 17).

The difficulty of allowing for relevant subsets is not just technical but also one of judgment (subjectivity), since the auditor or other test user must ultimately determine for himself or herself that the sample in question belongs properly to a certain defined reference set, in the sense that there is no 'more relevant' subset to which it also belongs. In his theory of significance testing using P values (see below), Fisher gave much attention to the problem of relevant subsets (cf. Seidenfeld, 1979: 71–75; Johnstone, 1987a), whereas for Neyman relevant subsets were not an issue. Because Fisher wanted a measure that related validly to *a single test* he had no choice. Neyman, having given up on this ambition, resorted to measures that attach only to a hypothetical unending sequence of test repetitions, wherein all samples are drawn strictly at random and 'the bad ("unlucky" or "unrepresentative" random samples) cancel out the bad':

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[10] The option of scrapping a non-random-looking ('unlucky') random sample and drawing again (Student, 1937: 366; Cox, 1958: 87–9; Good, 1974: 123; Savage, 1976: 464; Lindley and Novick, 1981: 52) is not available within the N-P formulation, because the guarantee of predetermined frequencies of Types I and II errors over the long run is dependent on strict random sampling without any subjective or personal interference (cf. Seidenfeld, 1979: 36; 71; Johnstone, 1995: 168).

> '...for me the probability $P\{E\}$ of an event E in an experiment to be performed is not a measure of the degree of certainty that E will actually occur. For me, $P\{E\}$ designates an idealization of the relative frequency with which E occurs in repeated trials of the same kind' (Neyman, 1963: 929).

> 'It would be nice if something could be done to guard against errors in each particular case. However, as long as the postulate is maintained that the observations are subject to chance (in the sense of the frequentist theory of probability), all that appears possible to do is to control the frequencies of errors in a sequence of situations...' (Neyman, 1971: 13).

Error frequencies can be measured over Neyman's conceptually infinite population of test repetitions in a way which is purely mathematical and thus objective. It is, however, not possible to arrive at such objective measures if the reference set is conditioned on what are seen to be the relevant 'ancillaries' of a particular sample, these being a matter of judgment (e.g. is it relevant that the invoices in a sample are predominantly very recent?). Fisher was prepared to make judgments on such matters but Neyman would not admit any requirement for judgment into the assessment of error probabilities. The end result of this philosophical disputation was that Neyman was left with 'objective' measures, which, on his own admission, were meaningless with respect to single tests, whereas Fisher arrived at measures that did apply to the single case, but only so long as the user was satisfied with the 'randomness'[11] (here meaning subjective representativeness) of the sample observed in that particular case. The element of express subjectivity in Fisher's logic is the price that he paid to achieve results which were (he argued) of relevance to those test users concerned not merely with the long run of test repetitions, but more particularly with the single case at hand.

There is little discussion in the literature of where the auditing profession stands on this very fundamental issue. Is classical statistical sampling in auditing justified only by its error frequencies over repeated tests in repeated audits conducted by the firm or profession as a whole, or is there a Fisherian attitude on which each particular test result means something of itself, presumably in terms of evidence? This issue, which arises in all fields using classical statistical methods, particularly hypothesis tests and confidence intervals, was put by Hacking (1965) as follows:

> 'There is no general agreement on whether rejection should be studied in terms of evidence or strategies' (Hacking, 1965: 74).

Reading between the lines, there are clear indications of both standpoints in auditing literature, individual authors nearly all advocating the N-P 'repeated trials' justification of tests and yet most also interpreting test results in singular, evidential and thus innately Fisherian terms. The most direct statement to do with this issue in auditing literature, to my knowledge, is that of Scott (1984b) who appears to support an N-P long-run philosophy, although without completely dismissing the possibility of a Fisherian type single case interpretation:

> '...the auditor will have a portfolio of clients and, indeed, may audit the same client for many years. The audit firm will have a particular audit strategy that, broadly speaking, is applied to all clients. This strategy may well include a specification that statistical tests will run, say, a 5% risk of missing a material error. Then, the ex ante reasoning underlying the Neyman-Pearson methodology seems reasonable when applied to a firm wide audit strategy even though it may not be reasonable, strictly speaking, when applied to an individual audit report' (Scott, 1984b: 93).

The profound weakness of the N-P repeated trials, low error frequencies argument is that although it is 'objective', and is what we have all been taught to rely on when conducting hypothesis tests, it is unable to justify the interpretation of a given sample observation in terms of a single-case-specific, measure of evidence (for or against either of the hypotheses tested). Auditing, however, more so than most professions, is all about evidence. In test applications such as acceptance sampling in industry, it is perhaps reasonable that engineers merely draw a sample and make a mechanical and immediate decision to either 'accept' (market) or 'reject' (rework) a batch of product. In this context no single case is of more than routine importance and it is economical to proceed knowing that over the long run there will be relatively few incorrect acceptances (Type I errors) or incorrect rejections (Type II errors). But in auditing, each single case is *of itself* important and requiring of an assessment of sample evidence, each such assessment playing some part in the manifold evidential underpinning of decisions on further audit procedures and ultimately on what to report. If viewed in this light, auditing has vastly more in common at a foundational level with Fisher than with the theory of hypothesis tests and confidence intervals developed by Neyman and Pearson.

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[11] Fisher defined 'randomness' in two senses. One was the usual classical notion on which a sample is random if it was selected by a process on which each possible sample has an equal probability of selection. The other was a subjectivist notion on which a sample is random if it cannot be seen to belong to a relevant (peculiarly distributed) subset of all possible samples (e.g. Fisher, 1973: 35, 113–4). Interestingly, Fisher's logic requires that samples be random only in this sense and not in the classical sense. This is also the Bayesian position (cf. Seidenfeld, 1979: 75; Berger and Wolpert, 1984: 115; Johnstone, 1989: 444–5; Gelman et al., 1995: 221–3), another point on which Fisher is more Bayesian than classical.

6. Bayesian interpretation

Standard Bayesian calculations for the binomial test described above are as follows. Assuming a beta (conjugate) prior with parameters a and b $(a,b>0)$, the posterior distribution of the population error rate ρ is also beta, with parameters $a+k$ and $b+n-k$, k denoting the number of errors observed in n trials (DeGroot, 1986: 321–2; Steele, 1992: 68–71). The posterior probability of H_0, $p(H_0|k, n)$ is given then by the normalised incomplete beta function:

$$\{\Gamma(a+b+n)/(\Gamma(a+k)\Gamma(b+n-k))\}\int_0^{.15}\rho^{a+k-1}(1-\rho)^{b+n-k-1}\,\delta\rho, \qquad (1)$$

values of which can be obtained from standard mathematical and statistical software packages without need for any programming.

From a Bayesian view, whether H_0 is 'accepted' or 'rejected' in classical terms is of no concern. Rather, what is required is a representation of the sample data which is, in Bayesian language, evidentially 'sufficient', or in other words fully representative of everything in that data which affects the probability of H_0. From this point of view, the two results considered $(n=30,\ k=1)$ and $(n=100,\ k=9)$, are well represented as such, and all that is required is calculation of posterior probabilities $p(H_0|k, n)$ from (1) above. The only difficulty faced is that of determining reasonably appropriate values for the beta prior parameters (a, b).

One possible approach, which is quite 'objective' and highly informative, is to calculate posteriors over appropriately broad classes of priors rather than just for one prior distribution in particular. This helps the user gauge the direction of the evidence (for or against H_0) and its strength, by revealing the robustness or insensitivity of particular qualitative conclusions (e.g. 'H_0 is strongly supported') against the values of parameters a and b. For example, if it could be shown that whatever beta prior (a, b) is used within the class of all reasonable (i.e. not ridiculous) priors, the posterior probability of H_0 is say 0.95 or greater, then the auditor could argue, very defensibly, that his or her sample evidence strongly supports the proposition that H_0: $\rho \leq 0.15$. Since such a conclusion does not hinge on any particular prior, it can be said to be 'objective', thus countering the conventional wisdom that Bayesian analysis can only be 'subjective'.

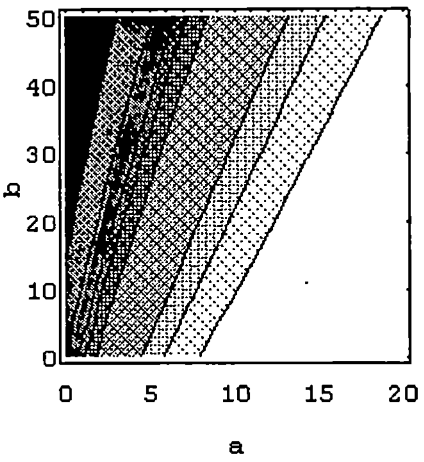
If a robust Bayesian conclusion is not available over the whole class of priors considered reasonable possibilities, the alternative is to get more data (or to rely more heavily on other sources of audit evidence). Bayesian inference has the logically appealing characteristic that as the sample size increases, the prior distribution becomes less and less important to the posterior. This is called 'data swamps prior', and means in effect that for two or more different prior distributions (prior beliefs), no matter how different, there is always a sample size great enough to make the respective posterior distributions identical. In the limit, this sample size might be the population size, but in many practical situations, where there are some basic commonalities in different individuals' prior beliefs, the sample size required to achieve qualitatively equivalent conclusions may not be great. Whether or not this is so in auditing can only be ascertained with empirical research in actual audit contexts.

There is the possibility that low (by conventional standards) sample sizes might be found to be sufficient, in which case it could be argued that Bayesian analysis would save auditors money (cf. Edwards, 1995: 182–3). There is also the possibility that conventional sample sizes might be found wanting by the standards of producing Bayesianly robust conclusions, something which, if true, would also be important to know.

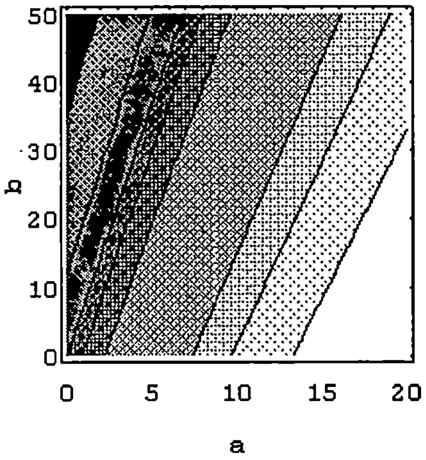
To exemplify the type of 'objective' Bayesian analysis advocated above, we now find posterior probabilities $p(H_0|k, n)$ for the two assumed test results $(n=30,\ k=1)$ and $(n=100,\ k=9)$ over all beta priors (a, b) for which $a \leq 20$ and $b \leq 50$. This is an extremely broad class of priors designed to allow for almost any possible (not unreasonable) pre-test belief distribution on the part of the auditor. The priors covered include, at one extreme, distributions heavily skewed right on which $p(H_0$: $\rho \leq 0.15)$ is very high, and at the other (almost unthinkable) extreme, symmetric 'normal looking' priors giving very high probability to ρ values around 0.5 and almost negligible probability to H_0: $\rho \leq 0.15$. There is also everything in between, including what is the typical or even obvious class of priors in audit compliance testing, namely priors skewed right yet ascribing moderate to low

Figure 1

Contour (Equi-Posterior) Plot of $p(H_0|k, n)$ Given $n=30$ and $k=1$ With Prior Parameters $a \leqslant 20$ and $b \leqslant 50$



Contour (Equi-Posterior) Plot of $p(H_0|k, n)$ Given $n=100$ and $k=9$ With Prior Parameters $a \leqslant 20$ and $b \leqslant 50$



prior probability to H_0 (the lower $p(H_0)$ the more 'conservative' the starting point.)[12]

Calculation and presentation of posterior probabilities over such a wide class of priors is easiest using computer graphics, the presentation here being by way of contour plots. Figure 1 shows contour (equi-posterior) plots of $p(H_0|k, n)$ for each of the two supposed results for all possible ($a \leq 20$, $b \leq 50$) parameter combinations. The values of the contours are 0.999, 0.99, 0.97, 0.95, 0.90, 0.5, 0.3, 0.1 going from left to right (i.e. the value of $p(H_0|k, n)$ decreases as the shading becomes lighter). Contours with values less than 0.9 are not shown in fine detail, on the grounds that we are interested in concluding that the probability of H_0 is very high, say 0.9 or higher, and hence it is the extent of (a, b) combinations for which this is true which is of foremost interest.

The plots in Figure 1 reveal that $p(H_0|k, n) \geq 0.9$, for a wider range of (a, b) combinations (priors) in the case of the ($n=100$, $k=9$) 'rejection' of H_0 than for the ($n=30$, $k=1$) 'acceptance'. This implies that the $n=100$ rejection carries more forceful, or more robust, evidence in favour of H_0 than does the $n=30$ result, on which H_0 is formally accepted. That is, marginal 'rejection' of H_0 with large n more supports H_0 than does 'acceptance' of that hypothesis with smaller n. This is a further manifestation of the 'incoherence' demonstrated in Johnstone (1995) and Aldersley (1994). In the cases of both these two results, the class of priors over which $p(H_0|k, n) \geq 0.9$ is characterised by b

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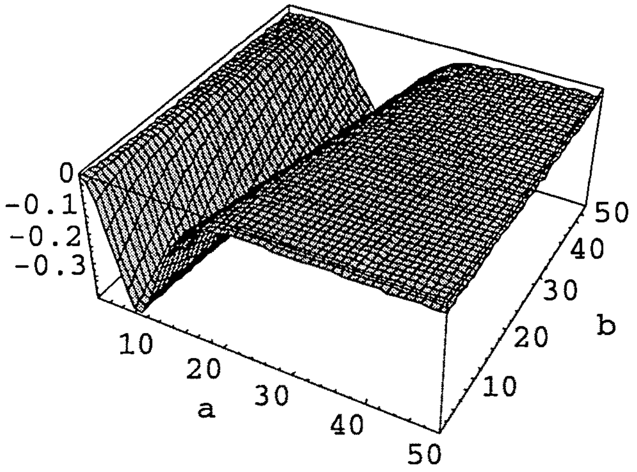
[12] Note that a beta prior is skewed right if $a<b$, the more so the greater the relative difference between these two values. If $a=b$, the prior is symmetric (almost normal for largish a, b) and if $a=b=1$ it is uniform. See Steele (1992: 66–7) and Pratt et al. (1995: 182–6) for depiction of various possible beta distributions.

Figure 2
Surface Plot of the Difference in Posterior Probabilities
$p(H_0|k=1, n=30)$-$p(H_0|k=9, n=100)$
With Prior Parameters $a \leqslant 50$ and $b \leqslant 50$



much greater than a (i.e. priors skewed right); however, the larger sample result satisfies this condition even for prior distributions on which the prior probability of H_0, $p(H_0)$, is very low.

From a Bayesian perspective, both ($n=30$, $k=1$) and ($n=100$, $k=9$) tend to support the hypothesis H_0: $\rho \leq 0.15$, since in both cases the observed sample proportion k/n is some amount less than 0.15. An observed proportion less than 0.15 must surely, on any reasonable inductive logic, tend to support H_0: $\rho \leq 0.15$ against H_1: $\rho > 0.15$. Although this is recognised intuitively by most classical statisticians, the N-P argument is that the ($n=100$, $k=9$) 'rejection', on which $k/n=0.09$, is statistically 'too close' to $m=0.15$ to allow acceptance of that hypothesis. The mathematical criterion on which this ruling is made is that of an N-P hypothesis test with (in our case) maximum Type II error probability equal to $\beta=0.05$. To achieve such a low Type II (most important) error probability, the 'critical' value of k/n has to be set well inside $m=0.15$, and in the ($n=100$, $k=9$) test, $k/n=9/100$ is exactly that value and hence H_0 is 'rejected'.

The Bayesian criticism of this Neyman-Pearson frequentist test criterion is that it is 'incoherent' (logically inconsistent) in that it leads to 'rejection' of H_0 on data which support that hypothesis more forcibly than other data sets on which H_0 is 'accepted'. Incoherence is demonstrated graphically in Figure 2, which plots the difference between the two posterior probabilities,

$$p(H_0|k=1, n=30)-p(H_0|k=9, n=100),$$

over $a \leq 50$ and $b \leq 50$. The difference is found to be either negligible or negative depending on the (a, b) pair considered, indicating that the $n=100$ 'rejection' of H_0 offers the same or greater evidence in favour of H_0 as the $n=30$ acceptance, regardless of the prior. Within the most likely class of priors, those with very small a, and b equal to three or four or more times a (i.e. heavily skewed right), the $n=100$ result leads to a value of $p(H_0|k, n)$ generally not much greater than that conditional on the $n=30$ result, but greater nonetheless. For other less plausible priors the difference between these probabilities, in that same direction, is as much as 0.3 or more.

The Bayesian interpretation of statistical tests, as illustrated above, is technically elementary, but the principles involved and the results revealed have very serious connotations in regard to classical, N-P style hypothesis tests. Specifically, N-P methodology, as practised in auditing, is seen to be inherently limited by its (i) not making use of all the available data, and (ii) not recognising the post-test relevance of the sample size n. These points will now be elaborated upon with further calculations.

6.1. Use all the Data

The results of N-P style hypothesis tests are generally characterised by whether H_0 is 'accepted' or 'rejected'. For a Bayesian analysis, this is not very meaningful, because the posterior probability of H_0 depends on the exact value of k observed, and differs greatly for different k values within either the acceptance or rejection region of a test. To know that H_0 is rejected is to know only that k is greater than or equal to a given critical value k_c (e.g. for $\beta=0.05$ and $n=30$, $k_c=2$) and that is not sufficient, since the posterior probability of H_0 is often some orders of magnitude lower for k

much greater than k_c than for k equal or close to k_c. The dependence of the probability of H_0 on k is demonstrated in Figure 3. This is a plot of $p(H_0|k, n)$ as a function of k holding $n=100$ constant. The beta prior parameter b is set at 50 and the other parameter a is allowed to vary between 0.01 and 50, thus allowing for almost any shaped prior the auditor might care to use. With $\beta=0.05$ the critical value of k in this test is $k_c=9$ (i.e. 'reject H_0' if $k \geq 9$). The graph shows great variation in the posterior within both the acceptance ($k<9$) and rejection ($k \geq 9$) regions of the test, over all values of prior parameter a less than about 30 (representing prior probabilities $p(H_0)$ from about zero to one).

The moral evident from Figure 3 is that expressions which summarise an exact observation (n, k) in terms only of whether H_0 is 'accepted' or 'rejected' fail to purvey all the evidence. Such expressions have the same effect as would a 'wanted poster' which described a 5ft suspect as 'less than 6ft'. Much information content is lost, and ensuing inferences are almost bound to be wrong, at least in degree if not qualitatively. A jury would feel greater confidence in condemning a person who was 5ft tall if the witnesses described the culprit as such, rather than as someone who was no taller than 6ft. The same is true in hypothesis testing, where an auditor trying to infer the truth of H_0 is not well served by broad categorisation ('accept' or 'reject') of what was, to begin with, a very precise observation. References on this point in Bayesian literature include Berger and Mortera (1991) and Johnstone and Lindley (1995).

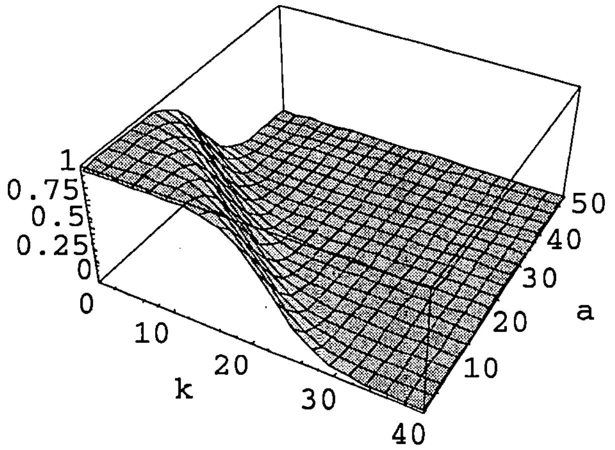
6.2. Allow for the Sample Size

Auditors conducting (non-sequential) hypothesis tests are well versed in the need to fix n in advance so as to make the error characteristics (α, β) of their tests (i.e. the maximum Type I and Type II error probabilities) appropriate to the circumstances. This methodological requirement makes sense to a Bayesian, although it is expressed in terms of expected information or losses rather than in terms of error probabilities and power. On a Bayesian understanding of classical tests, consideration of n begins with the problem of test design, and should carry on, after the test is run, in its interpretation. By comparison, if, on the classical exposition, n was considered relevant after the test, results would be viewed not simply in terms of whether H_0 is 'accepted' or 'rejected', but in relation also to the sample size at which that result was achieved. Questions would then arise as to whether two results such as ($n=30$, reject H_0) and ($n=100$, reject H_0) have different meanings (cf. Pratt, 1977). But this does not occur. In classical statistics textbooks, there is rarely a hint that n might be relevant post-test, at the stage of interpretation, as much as in the pre-test design stage, the only well known exceptions to this generalisation being Kendall and Stuart (1979: 197), Cox and Hinkley (1974: 397–8) and Lehmann (1986: 125), the last of which represents in effect only a footnote.

That there is not more made in classical statistics of the post-test relevance of n is of some frustration to Bayesians, who have long argued this point:

> 'It is an astonishing historical fact that Neyman and Pearson, and later Wald, never thought of comparing their results for different sample sizes. It is even more astonishing that more recent workers have ignored the idea' (Lindley, 1978: 6).

Figure 3
Plot of $p(H_0|k, n)$ Against the Actual Number of Errors k and Prior Parameter a (With $b=50$ and $n=100$)



To a Bayesian such as Lindley, the concession among a minority of classical statisticians (references above) that n is relevant *post-test* represents the mature or considered classical position. A Bayesian put in the position of a classicist having to interpret a 'rejection' or 'acceptance' of H_0 would argue that, despite this 'truncated' representation of the sample data, there is still something to be gained by allowance post-test for the sample size. This can be seen by considering the posterior probability of H_0 conditioned not on k (as is preferred) but on the lesser information that $k \in A$ or $k \in R$, where A and R denote the acceptance and rejection regions of the sample space respectively. Let us begin with $k \in R$. The probability of H_0 given this information is:

$$p(H_0|k \in R) = p(H_0)p(k \in R|H_0)/p(k \in R), \qquad (2)$$

which, in the case of the beta prior and binomial sampling distribution, is easily computed using simulation. Table 1 shows results of calculations over increasing values of n. The beta prior parameters used are $a=7$ and $b=31$, just for example, implying a prior probability $p(H_0)$ equal to 0.3155.[13] It is found that in conditioning the probability of H_0 on rejection of that hypothesis in a classical test, the sample size n is very important. Specifically, as n increases, this probability $p(H_0|k \in R)$ becomes smaller, implying increasingly strong evidence against H_0.

To a Bayesian, the finding that $p(H_0|k \in R)$ decreases with increasing n says two things. One is that the result 'reject H_0' ($k \in R$) cannot be interpreted properly without considering n, and the second, confirming what was held above, is that treating a test result only in terms of the summation 'reject H_0' is liable to greatly mislead (even if this information is interpreted Bayesianly with reference to n). To see how this can happen, consider the possibility that the observed result k only marginally rejects H_0, indeed suppose $k=k_c$, k_c denoting the critical (rejection) level of the sample statistic k (reject H_0 if $k \geq k_c$). The probability of H_0 on a result of this description,

$$p(H_0|k_c),$$

does not decrease as n increases, but in fact increases. The limit of this probability for increasing n is $1-\beta$ (whatever the prior), which for small β (as auditors require) is near one. Proof of this limit is provided in the Appendix. See also an analogous two-sided result in Johnstone (1995: 162–3). Note also that even for small n, $p(H_0|k_c)$ greatly exceeds $p(H_0)=0.3155$, indicating that marginal rejection of H_0: $\rho \leq 0.15$ in the 'negative' test described actually represents evidence *supporting* H_0 (cf. Johnstone, 1995: 161–3).

The contrary behaviour of $p(H_0|k \in R)$ and $p(H_0|k_c)$ over increasing n is illustrated, again with beta prior parameters $a=7$ and $b=31$, in Figure 4 (remember $p(H_0)=0.3155$). It can be seen from this plot that when we know only that H_0 is rejected, we feel less confidence in H_0 the larger n, but when we know that this rejection is only marginal, then as n increases we become more and more confident, rather than less confident, that H_0 is actually true. It is a great mistake, therefore, to conceive of a result k which equals or is fairly close to k_c as just a rejection of H_0 like any other. To observe $k=k_c$ and yet view this result as $k \geq k_c$ (or actually as $k_c \leq k \leq n$ since k obviously cannot exceed n) suppresses crucial information, greatly distorting the evidence represented. In this way, classical N-P type hypothesis tests, which characterise all test results as either 'accept H_0' ($k<k_c$) or 'reject H_0' ($k \geq k_c$), are inherently flawed in their representation of evidence.

Having considered the behaviour of $p(H_0|k \in R)$ in comparison with $p(H_0|k_c)$, brief consideration is

Table 1
Values of $p(H_0|k \in \mathrm{R})$ for increasing n

n	$p(H_0\|k \in \mathrm{R})$
10	0.3136
20	0.2995
30	0.2872
50	0.2748
70	0.2715
90	0.2695
100	0.2669
200	0.2268
300	0.2012
400	0.1908
500	0.1746

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[13] These were the example values employed in similar beta-binomial calculations in Aldersley (1994).

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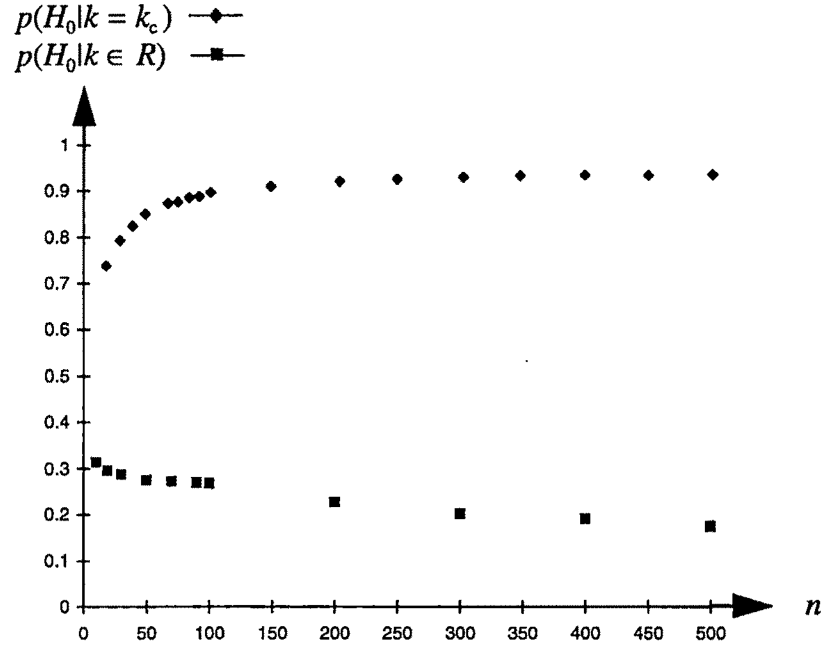
Figure 4
Comparative Plots of $p(H_0|k \in R)$ and $p(H_0|k_c)$ with increasing n



given now to the other possible result of a classical hypothesis test, that of an acceptance. Thus, we now consider $p(H_0|k \in A)$. There is nowhere near the inconsistency between this probability and $p(H_0|k_c)$ as occurs with $p(H_0|k \in A)$. Both $p(H_0|k \in A)$ and $p(H_0|k_c)$ approach limits near one as n increases, and only for smallish n is there likely ever to be any material difference between these probabilities. Observe, for example, the comparison with $a=7$ and $b=31$ in Figure 5. Note that although $p(H_0)$ is only 0.3155, both probabilities are high for small n and tend to nearly one as n becomes large.

The reason for the necessary convergence of $p(H_0|k \in A)$ and $p(H_0|k_c)$ with large n is that for all $k \in A$ (i.e. for all $k < k_c$), $p(H_0|k) > p(H_0|k_c)$, and since $p(\mathrm{H}_0|k_c) \rightarrow 1 - \beta$ with increasing n, then so too must $p(H_0|k \in A) = p(H_0|k < k_c)$ be near one (assuming small β). That is, it does not matter to our inference when we know only that $k < k_c$ when in fact the probability of H_0 is very high for all $k < k_c$. There is, as a result, not the same degree of Bayesian dissatisfaction with the result 'accept H_0' as with 'reject H_0'. Provided that n is sufficiently large (how large this is depends on the prior), a Bayesian analysis conditioned on 'accept H_0' will yield qualitatively the same results as that conditioned on the precise value of k observed. This is not true at all of the other possible test outcome, 'reject H_0', which, on a Bayesian analysis, is in a sense more and more ambiguous as n increases, since the range of possible posterior probabilities $p(H_0|k, n)$ over $k \in R$ becomes wider and wider.

Although not the subject of this paper, the conventional and widely promulgated audit risk model (AICPA, 1983) comes to mind here in that it conceives of the sample result k (e.g. k = the sample mean misstatement in a test of details) as either $k \in A$ or $k \in R$, rather than as the actual observed value of k. The findings outlined above reveal the inadequacy in general of this form of data capture, thus adding to the already documented prescriptive criticisms of the conventional audit risk model. It could be argued that it is only if we are trying to be Bayesian in our use of this model (e.g. CICA, 1980: 97) that the above findings are relevant. Surely, however, no inference methodology that makes use of less than all the available data content can be ideal. Rather than comment further here, I will merely raise the issue as one that does not seem to have been noted previously in the audit risk context.

A paper in accounting literature that came near the point but erred in its final analysis is Burgstahler (1987). This was an effort to explicate the evidential interpretation of hypothesis tests in empirical research by plugging test outcomes into a Bayesian analysis. Taking this approach, Burgstahler (1987: 205–7) found that the Bayesian probability of the null hypothesis, given rejection of that hypothesis at a specified significance (alpha) level, decreased with increasing sample size or power, suggesting therefore that a significant (at level α) result carries stronger evidence against the null for larger n:

> 'For more powerful [e.g. larger n] tests, there is a lower degree of belief in the null (and greater belief in the alternative) as a result of observation of a significant statistic....Even if the results from a test with low power are significant, the results have little value; even significant results from a low power test do not cause much change in a Bayesian's beliefs about the null hypothesis....The statement that significant results are evidence against the null hypothesis is, by itself, incomplete; significant results are only strong evidence against the null for powerful tests' (Burgstahler, 1987: 207).

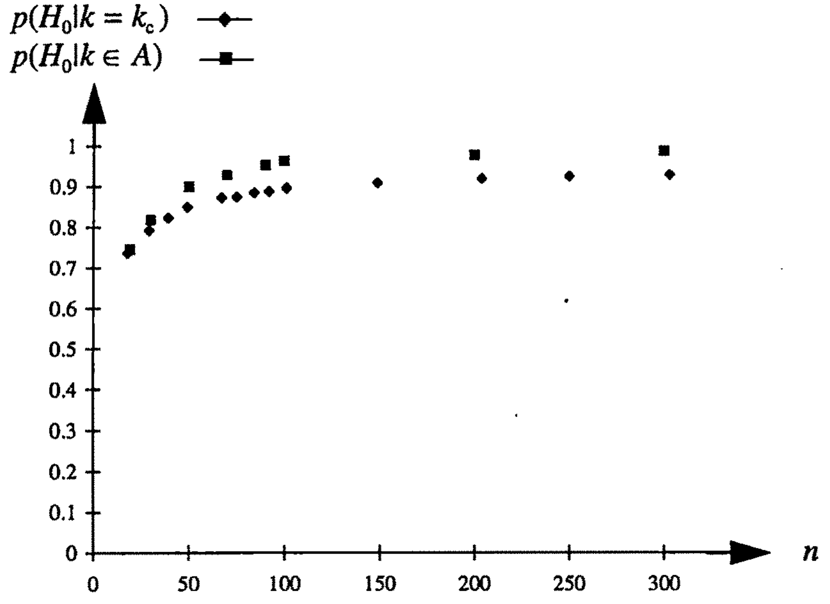
Burgstahler's logic is correct in general only if we are prepared to treat $k=k_c$ (marginal significance at any given level α) as merely broad rejection at α—that is, as $k \in R$ or $k \geq k_c$—thus suppressing information. Moreover, when the actual observed value of the test statistic, k_c, is given its proper representation, the posterior probability of the null hypothesis conditional on that result, $k=k_c$, is found to increase with n, which is, of course, precisely the opposite to Burgstahler's conclusion. A mistake such as this could not have occurred if more attention had been paid to the literature in statistics. It has been known to Bayesians since Jeffreys (1961) and Lindley (1957) that marginal significance at a given α level carries less (not more) weight against the hypothesis rejected as n increases (see later quotes).

Returning to the auditing literature, Burgstahler's error has roots throughout the related work of Kinney. In his well known decision theoretic model of auditing, which is commonly seen as Bayesian, Kinney (1975a; 1975b) conditions the probability of the hypothesis in question not on the exact value of the observed statistic but on whether that value falls into the acceptance ($k \in A$) or rejection ($k \in R$) region of a classical hypothesis test. Kinney's model is therefore inherently flawed in its depiction of statistical data in the same way as that which so misled Burgstahler, and for this reason alone is not properly Bayesian.[14]

7. Fisherian interpretation

Fisher (e.g. 1973: 44–7; 80–1; 103–4) denounced the Neyman-Pearson framework for its failure to provide what users of hypothesis tests so generally require, namely an assessment of the sample evidence relative to the hypothesis tested. On the Fisherian view, a hypothesis test should lead to a measure of evidence. This measure might become part of the basis for a decision (choice of action), either of itself or in combination with other sources of evidence. Or, in circumstances where there is no action choice hinging on whether or not

Figure 5
Comparative Plots of $p(H0|k\ A)$ and $p(H0|kc)$ With Increasing n



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[14] It is this mistake which has led to the simplistic view that auditors can be Bayesians in effect or at least spirit and yet practise only non-Bayesian statistics.

H_0 is supported by evidence, a measure of that evidence might serve only as an addition to a knowledge base or as a mere scientific curiosity.

According to Fisher's argument, hypothesis tests can be used either for inference just for the sake of inference, or for inference as a logical precursor to decision-making. In auditing, the latter is, of course, more likely, since evidence is sought for the purposes of supporting decisions (e.g. decisions to proceed from compliance tests to tests of details; to require adjustment of an account balance; to qualify accounts, etc.). There is rarely the luxury for 'pure science' in auditing practice, contrary to what has always been characteristic of statistical tests in the research disciplines, such as agriculture and genetics, in which Fisher worked.

Fisher's depiction of hypothesis tests as providing either for inference as an end in itself or for inference as a foundation for action (decision), is also that of most Bayesians. There is, however, much Bayesian dissatisfaction with Fisher's measure of the evidence provided by a hypothesis test. Both the Fisherian and Bayesian frameworks measure evidence on a [0,1] interval scale, but rather than the probability of the hypothesis H tested[15], Fisher's measure of evidence is the 'P value' of the data conditional on H being true. This construct is defined in general as the probability on H of data as or more 'discrepant' with that hypothesis as that data actually observed. Assuming that discrepancy with H is measured by the test statistic k (in our case, k is the number of errors observed in the sample), Fisher's P value with respect to H is:

$$P(k_{obs}) = p(k \geq k_{obs} | H, n),$$

where k_{obs} is the value of k observed and '$\geq$' is a logical operator meaning 'at least as discrepant with H as'.

A P value is a probability, albeit not the probability of H, and hence must lie between zero and one. Fisher's argument is that the smaller the P value, the stronger the evidence against H, with observed P values less than 5% being regarded by an institutionalised rule of thumb as 'statistically significant' and constituting objectively strong evidence against H. The logic on which this argument rests (e.g. Fisher, 1973: 42) is as follows. Having observed datum k with P value $P(k)$ on H, it can be concluded that *either* (i) H is true and an event (i.e. $k \geq k_{\text{obs}}$) of probability $P(k)$ has occurred *or* (ii) H is false. Of these two mutually exclusive and exhaustive possibilities, the lower the value $P(k)$ the harder it is to accept the former (H true) and the easier it is to accept the latter (H false). If in the limit $P(k)$ equalled zero, H would have to be false (since such k could not occur if H were true). For $P(k)$ very close to zero, the inference is that while H is not absolutely disproven it is very strongly discredited.[16]

Until relatively recent times, users of hypothesis tests could not easily compute P values. Fisher got around this problem by tabulating 'critical' values of the test statistic (t, F, χ, etc.) at chosen thresholds, typically 1%, 5% and 10%. Users could then determine using these tables whether their observed P values were less than 5%, or between 1% and 5%, etc. For many years before the advent of personal computers and readily available statistical software, the use of tables with conventional hurdles (like 5%) was the norm. It was always Fisher's view, however, that although these threshold significance levels made convenient benchmarks, it was not whether P was greater or less than 5%, but rather the exact value of P, which fully represented the evidence. On this view, to know that P is less than 5%, for example, is a start, and perhaps enough for the initial screening purpose of the test,[17] however, the real enterprise of hypothesis or significance testing (logical assessment of evidence) is only satisfied properly by calculation of P. This is obvious once we understand that on Fisher's logical use of P, an observation with P value 0.04999 is indiscernible in its evidential meaning from one with P value 0.05001. If these results were really different in their entailed evidence, then the accuracy of numerical approximations in software and elsewhere would have unnatural importance. Mere rounding might lead to a qualitative change in the conclusion of a test. The following quotes are indicative of Fisher's position on this point:

> 'Convenient as it is to note that a hypothesis is contradicted at some familiar level of significance such as 5% or 2% or 1% we do not, in Inductive Inference, ever need to lose sight of the exact strength which the evidence has in fact reached, or to ignore the fact that with further trial it might come to be stronger, or weaker' (Fisher, 1966: 25).

> 'The actual value of P obtainable from the table by interpolation indicates the strength of evidence against the hypothesis' (Fisher, 1970: 80).

Here, Fisher is in philosophical accord with the Bayesian view and in stark disagreement with Neyman. From the N-P viewpoint, a 'critical' significance level of 5% means a Type I error probability α of 5%, and any result for which $P \leq 5\%$ means simply that H is 'rejected' in a test with that error probability. To consider the result 'reject H' as fully representing the sample evidence is thus tantamount to reporting not P itself but merely that $P \leq 5\%$, when according to Fisher this is not an adequate representation of data. The added strength of the Bayesian argument over Fisher's criticism of the N-P 'accept or reject' depiction of data is that the deficiency of this mode of representation can be demonstrated using probabilities on H. It was found above, for example, that over a sample sub-space $\{k\text{: } 0 \leq P \leq 0.05\}$, in which H is rejected, $p(H|k, n)$ can vary in the extreme between almost 0 and 1, the exact value of the posterior being highly dependent on $P(k)$, that is on the precise value of k, especially for large n. Part of Fisher's longstanding dissatisfaction with the N-P framework is thus clarified and reinforced by Bayesian analysis.

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[15] Only one hypothesis is specified under Fisher's formulation. Reference to an alternative hypothesis is implicit, particularly in the choice of an appropriate test statistic.

[16] References on the logic of Fisherian significance tests include Kyburg (1974), Seidenfeld (1979) and Johnstone (1987a).

[17] Fisher (1966: 3) used 5% as a filter with which to determine whether there was enough of an experimental effect evident to warrant more extensive research. Those hypotheses meeting the quite arbitrary 5% rule 'made the cut' (4% or 6% would have done about as well).

A Fisherian P value analysis of the two hypothetical test results presumed in this paper is very straightforward, demanding only that we compute the P values of these results in a way which while following Fisher, is consistent in form (mathematics) with the preceding N-P treatment. This requires that P values be conditioned not on the 'null' hypothesis H_0, as was Fisher's convention, but on the alternative hypothesis H_1: $\rho > 0.15$. As explained above, this departure from classical statistics' conventions is dictated by the desire to keep with conventions in auditing, wherein the N-P recipe governing the labelling of hypotheses H_0 and H_1 is generally not recognised. Note also that because P values are to be computed on H_1 (not H_0), it is the probability of $k \leq k_{obs}$ which must be found (smaller, rather than larger, values of k being more discrepant with H_1).

Before calculating P values on H_1: $\rho > 0.15$, there is one further principle of Fisherian logic necessary to those calculations. This is to do with measuring P when the hypothesis tested is a composite (e.g. H_1: $\rho > 0.15$) rather than a simple or point hypothesis (e.g. H_1: $\rho = 0.15$). The composite hypothesis H_1: $\rho > 0.15$ is logically a disjunction $\{h_1$ or h_2 or h_3 or...$\}$ of simple hypotheses, each of the form h_i: $\rho = \rho_i$, where each ρ_i is a number in the interval $(0.15, 1]$. Thus, to hold that H_1 is true is to hold that one or other h_i in this disjunction is true. A P value $P_i(k)$ can be found for each of these point hypotheses $h_i \subset H_1$, and according to Fisher's logic the P value on H_1 is the maximum of all the $P_i(k)$. That is, the P value of k_{obs} on H_1 is approximated by:

$$\max_{H_1} p(k \leq k_{obs}|h_i, n),$$

which in the test of H_1: $\rho > 0.15$ discussed here is by:

$$p(k \leq k_{obs}|\rho = 0.15, n). \tag{3}$$

Fisher's argument, in the case of a composite null hypothesis, for using the maximum $P_i(k)$ over $h_i \subset H_1$ is that a disjunction $\{h_1$ or h_2 or h_3 or...$\}$ can be considered discredited by data only to the extent that its least discredited disjunct h_i is discredited. This is because a disjunction (composite hypothesis) is true if any of its disjuncts is true, and hence, according to Fisher, it is logical to work with the strongest or least discredited (highest P_i) of all the point hypotheses h_i comprising that disjunction.

Applying Fisher's logic, the P values of the two supposed test results are calculated from (3) as follows:

$$(k = 1, n = 30) \Rightarrow \text{P-level} = p(k \leq 1|\rho = 0.15, n = 30) = 0.0480$$

$$(k = 9, n = 100) \Rightarrow \text{P-level} = p(k \leq 9|\rho = 0.15, n = 100) = 0.0551.$$

Note here the formal equivalence with the N-P results, the $n = 30$ result having a P value on H_1: $\rho > 0.15$ of less than 5% (hence 'reject H_1' or 'accept H_0') and the $n = 100$ result having a P value on H_1: $\rho > 0.15$ greater than 5% ('accept H_1' or 'reject H_0').

Now, interpreting these results according to Fisher's logic for inference, both P values are seen to be 'low' in the primitive (undefined) sense that any event of probability around 0.05 is 'improbable'. In each case, therefore, the Fisherian conclusion is that there is strong or very appreciable evidence against H_1. Only the $n = 30$ result has a P value less than 5%, but according to Fisher, 5% or any other arbitrary partition has no magical significance. To the contrary, data sets with P values 4% and 6% are really of very much the same evidential significance. Only in the N-P paradigm is there a qualitative distinction between data with P values on either side of a 'critical' or 'magic' level, and that is because the N-P model is about decisions rather than evidence. In decision-making, the conclusion in any test has to be one thing or the other (otherwise there is no decision), but in assessing evidence there is no borderline dividing samples which support H_1 from those which discredit it. Rather than being dichotomous, inductive evidence is a matter of degree, Fisher's P value being his way, in the context of significance tests, of measuring that degree.

The problem with Fisher's logic from a Bayesian perspective is that P values are not generally reconcilable with posterior probabilities or any Bayesian concept of evidence.[18] The most basic premise which underlies all Bayesian criticism of Fisher's reduction of data to P values is that when interpreting a result of the form (n, k) the only summary or abstraction of that observation which preserves its evidential content with respect to the value of parameter ρ is the likelihood function $p(k|\rho)$. This is one way of expressing what is known in statistics as the 'likelihood principle':[19]

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[18] There is a very long established and extensive Bayesian

> 'Among all prescriptions for statistical behaviour, the Likelihood Principle stands out as the simplest and most far reaching. It essentially states that all evidence, which is obtained from an experiment, about an unknown quantity θ, is contained in the likelihood function of θ for the given data [i.e. in $p(data|\theta)$]. The implications of this are profound, since most non-Bayesian approaches to statistics and indeed most standard statistical measures of evidence (such as coverage probability, error probabilities, significance level, frequent risk, etc.) are then contraindicated' (Berger and Wolpert, 1984: 1).

The likelihood principle is sometimes taken as axiomatic or intuitively self-evident, but can also be deduced from Bayes' theorem,

$$p(\rho|k) \propto p(\rho)p(k|\rho),$$

in which only the likelihood term $p(k|\rho)$ involves the data k.[20] Applying this most general form of Bayes' theorem to a test of H_0 versus H_1, the posterior probability of H_0, following Berger and Sellke (1987: 115–6) can be written as

$$p(H_0|k) = 1 - \left[\frac{p(H_1)}{p(H_0)} \cdot \frac{1}{B}\right]^{-1}$$

where B is the (weighted) likelihood ratio, also known as the Bayes' factor,

$$\frac{p(k|H_0)}{p(k|H_1)}.$$

By expressing Bayes' theorem in this form, it is made explicit that the mechanism by which the data k determine the posterior probability of H_0 (and H_1) involves only the likelihood $p(k|H_0)/p(k|H_1)$. This ratio is, therefore, all that a Bayesian wants to get from the data. For the purpose of testing H_0 against H_1, anything else about the data is irrelevant and liable to mislead, other summary measures such as Fisher's P included.

The aspect of observed data k_{obs} by which a P value exhibits k_{obs} is the probability, on the hypothesis H in question, not of k_{obs} itself, but of a less specific description of that event, $k \leq k_{obs}$. From a Bayesian viewpoint (e.g. Berger and Wolpert, 1984: 104–9), a P value is thus a defective account of the evidence on two counts: (i) it mistakes what is really the event $k = k_{obs}$ for $k \leq k_{obs}$, thus suppressing or neglecting information, and (ii) it does not consider the probability on the alternative hypothesis of what was observed, and therefore stops short of measuring a likelihood *ratio.* A version of point (ii) was emphasised also by Neyman and Pearson in their reconstruction of Fisher's theory of significance testing. Their argument was that a hypothesis cannot be tested in isolation; there must be an alternative against which measures conditioned on the hypothesis tested can be made relative. That a P value on some hypothesis is low does not say much when this probability might be as low or lower on any admissible (possible) alternative. This is a point of agreement between the Neyman-Pearson and Bayesian standpoints. Otherwise the apparent commonalities in testing hypotheses are mostly between the Fisherian and N-P frameworks, as is to be expected given that these both suffer according to (i) by treating datum $k = k_{obs}$ as merely $k \leq k_{obs}$.

The seeming absurdity of hypothesis testing logic on which the data are so obviously misrepresented or misconceived was first explained in a now quite famous (at least among statisticians) and frequently quoted passage of Jeffreys:

> 'If P is small, that means that there have been unexpectedly large departures from prediction. But why should these be stated in terms of P? The latter gives the probability of departures, measured in a particular way, equal to *or greater than* the observed set, and the contribution from the actual value is nearly always negligible. *What the use of P implies, therefore, is that a hypothesis that may be true may be rejected because it has not predicted observable results that have not occurred.* This seems a remarkable procedure' (Jeffreys, 1961: 385).

Here Jeffreys is saying that because some hypothesis H gives zero or low probability to events $k > k_{obs}$ which have not occurred, the P value of k_{obs}, $p(k \geq k_{obs}|H)$, is low and hence H is 'rejected'. And thus, it can be said that H is rejected because events to which it gives low probability did not occur. Jeffreys (1961: 385) goes on to suggest that the non-occurrence of those events $k > k_{obs}$ 'might more reasonably be seen as evidence for the law [hypothesis H], not against it', since H implies

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literature on the deficiencies of Fisher's P value construct. References and discussion are provided in Edwards et al. (1963), Berger and Wolpert (1984: 104–110), Berger and Delampady (1987) and Berger and Sellke (1987).

[19] Introductory references include Cox and Hinkley (1974: 39–41), Berger and Wolpert (1984) and Pratt et al. (1995: 542–45).

[20] Others see the methods of Bayesian statistics as merely a way to put into effect or operationalise the likelihood principle, which they accept on other grounds or perhaps *a priori.*

('predicts') quite correctly that $k > k_{obs}$ will not occur.

Apart from Jeffreys' oft quoted argument, according to which Fisher's P value has a deep-seated design flaw, there are other bases on which P can be seen to be a deficient summary of evidence. The most telling of these is that although P values are calculated with reference to n the sample size, they are not truly 'standardised' against n in that a given P value (say 0.05) does not have the same evidential significance regardless of the sample size. To the contrary, depending on the sample size n, small P_{obs} can entail strong evidence either in favour of the hypothesis tested or against it. Generally, in tests of point null hypotheses (e.g. h_1: $\rho = 0.15$), a given P value (say 0.05 or 0.50) more and more supports that hypothesis as n increases. This was one of Jeffreys' (1961: 359–60) findings, elaborated on by Lindley (1957), and now referred to commonly as either Jeffreys' or Lindleys' paradox:

> '...the more powerful (larger) the test, the more a just significant result favors the null hypothesis' (Pratt, 1961: 166).
>
> '[A]s the sample size increases in testing precise hypotheses, a given P value provides less and less real evidence against the null' (Berger and Sellke, 1987: 136).

In regard to the interval hypothesis H_1: $\rho > 0.15$, against which P values are calculated in this paper, the effect of n is not as extreme or apparently paradoxical as that demonstrated in the case of point hypotheses by Jeffreys, Lindley and others. With H_1: $\rho > 0.15$, the probability of H_1 conditioned on the observed P value $P(k_{obs})$, i.e. $p(H_1|P = P(k_{obs}))$, approaches $P(k_{obs})$ as n increases, regardless of prior. That is, if we hold P at some constant value, say β, then the posterior probability of H_1 approaches that value β. And hence, as n increases, $p(H_0|P = \beta) \rightarrow 1 - \beta$, as was found above in the discussion on Neyman-Pearson theory. (Proof in appendix; note that in that previous discussion, the conditioning event $P = \beta$ was denoted $k = k_c$, k_c being the 'critical' value of k for a given maximum Type II error probability β.)

Although for sufficiently large n, $P(k_{obs})$ and $p(H_1|P = P(k_{obs}))$ are approximately equal, for smaller n, $P(k_{obs})$ does not have the same quasi-Bayesian, numerical validity. This can be shown by example. Consider possible data ($n = 10$, $k = 0$), on which $P(k_{obs})$ equals $p(k = 0|\rho = 0.15) = 0.19687$. The posterior probability of H_1: $\rho > 0.15$ on this result, letting $a = 7$ and $b = 31$ as previously, is 0.4295 (having begun with prior probability 0.3155). Now with large n, the probability of H_1 on a result with P value 0.1969 is approximately 0.1969 also, because of the asymptotic convergence of these measures.[21] Thus, a P value of 0.1969 can imply a posterior probability for H_1 of either 0.4295 or 0.1969 depending on the value of n. It is, therefore, not evidentially sufficient that the sample size was accounted for in the *calculation* of P. This calculation makes use of n and yet does not yield a measure which can be interpreted logically without further reference to n.

The post-test relevance of n is demonstrated here by way of comparison of posterior probabilities, each conditioned on the same value of P, and thus by involving a prior probability distribution. Any such demonstration, hinging on prior probabilities, may be discounted by classical statisticians on the grounds that P values are measured and interpreted on a logic which is, by design, free of any reference to the probabilities of hypotheses, prior or posterior, and that any appeal to these is antithetical and therefore inadmissible. The Bayesian rejoinder is that the exclusion 'on principle' of comparison of posteriors is tendentious and indeed contrary to the writings of Fisher and Neyman, both of whom advocated Bayesian probabilities as their first choice when empirical or other 'objective' priors were available (e.g. Neyman, 1957: 19; Fisher, 1973: 17).

Furthermore, the post-test n-effect can be equally well shown without reference to Bayesian probabilities. There are at least two ways of doing this. One is by comparison of likelihood functions rather than posterior distribution functions. Two test results with the same P value, one with large n and the other small n, give rise to very different and certainly not proportional likelihood functions, this disparity implying that notwithstanding their equal P values the two results have inherently different evidential connotations regarding parameter ρ. The other approach is to compare classical confidence intervals for ρ, holding the confidence coefficient constant at say 95%. The intervals generated differ greatly for large and small n results, despite those results having equal P values.

The Fisherian mode of inference, using P values, has not been nearly as widely promulgated within audit sampling as has the N-P framework. There is perhaps little difference in the minds of auditors between these rival classical schools, and it may be that although the discourse of hypothesis testing in auditing is predominantly that of N-P theory rather than of Fisher's significance tests, there is in fact a latent Fisherian influence on the way auditors interpret their apparently N-P based tests, particularly in the way that rejection or acceptance of the hypothesis tested is taken as evidence bearing upon the truth of that hypothesis. In Arens and Loebbecke (1981: 138), the acceptance of a hypothesis of no material error in what is, in form, a N-P hypothesis test (test of details), is justified in distinctly Fisherian terms, by reference to what are actually one-sided *P* values calculated on the alternate hypothesis. These are found to be very low, the highest being 0.025, which, according to the authors, explains why the hypothesis of no material error can be accepted (or why the alternative is rejected). More generally, however, both in this text and throughout the literature on audit sampling, there is an overriding N-P ethos, hypothesis tests and confidence intervals being explicated primarily in terms of their long-run average error probabilities, rather than by reference to *P* values or any concept of evidence.[22]

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[21] It is a peculiarity of the test described in this paper that these measures converge.

8. Bayesian statistics and the law

In defending classical methods against the Bayesian critique of Johnstone (1995) and Edwards (1995), Sennetti (1995) appeals to the authority of the courts, where the use of Bayesian statistics is not as long or well established as that of classical (N-P and Fisherian) methods. There is, according to Sennetti's argument, a threat that if auditors were to make greater use of Bayesian methods, their ability to persuade the courts of the reasonableness of statistical audit procedures would be less assured. This possibility, in addition to the 'transaction' costs of shifting audit sampling from a classical to Bayesian footing, is seen as explaining, if not justifying, the reluctance of audit firms to commit to an explicitly Bayesian approach.

The status of Bayesian statistics in US courtrooms is not clear. Although there have been suggestions that courts are untrained and unwilling to admit Bayesian analyses (cf. Sennetti, 1995: 195–6), there are precedents in the use of Bayesian statistics in legal argument, and indeed, in some legal matters, only Bayesian methods are used. Such matters include those of disputed paternity, where geneticists observe that the appropriate evidential measure is the Bayesian posterior probability of paternity, conditioned on the results of blood tests (Berry amd Geisser, 1986: 359). In these, and other cases involving matching of blood samples, classical methods have never been applied. Moreover, among some statistical theorists, there is a fundamental belief that methods of Bayesian statistics are generally more suited to legal inference than are their classical alternatives; and that, although the issue is contentious, courts should be made aware that the ways in which they interpret classical results are by nature Bayesian rather than classical, and thus only reasonable when applied to Bayesian calculations:

> 'Non-statisticians commonly misinterpret a *p*-value or a tail-area obtained in a significance test as the probability that certain results occurred by chance, but more important for our purposes, many statisticians themselves believe that significance tests, when properly interpreted, simply do not respond to the relevant questions in legal cases....Although [we] believe that Bayesian methods provide the only approach to statistical inference that both asks and attempts to answer the right questions, we recognise that the use of Bayesian methods based on subjective prior distributions in legal proceedings is controversial. Our view is that the Bayesian approach is what the court needs and often thinks it gets from the statistical analyses it hears, whereas what it usually gets is actually a frequentist or "classical" approach to statistical inference' (DeGroot et al., 1986: xi).

These remarks are indicative of the menace that faces classical statistics from within the statistics profession, but also of the potential criticism faced by auditors who apply classical statistical methods without proper appreciation of the limitations and logical weaknesses of those methods as compared with their Bayesian counterparts.

Even if we suppose for the moment that it is classical rather than Bayesian statistical methods that present least 'legal risk' to auditors, this risk can surely be further minimised by recognition of what Bayesian statistics have to add on the interpretation of classical results. At the very least, such comparative analysis should help auditors to avoid circumstances of extreme inconsistency between classical and Bayesian conclusions, and also to eradicate mistaken and indefensible 'classical' conclusions such as that of Guy et al. (1994: 50) cited above. There is a depth of methodological awareness which those using classical statistics can gain through critical (Bayesian or otherwise) re-evaluation of those methods, and without which auditors and others applying classical statistical routines are likely to present soft targets for those expert witnesses who have the advantage of understanding from both classical and Bayesian perspectives what classical results do and do not say.

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[22] Apart from the occasional hint that there may be something to be gained from a Fisherian *P* value approach (e.g. Sennetti, 1995: 197), auditing practice has remained wedded to the N-P framework within which it was first developed. This is despite hypothesis tests in empirical research in auditing having become quite Fisherian, at least in appearance, their results being now reported commonly in the form of *P* values rather than as either acceptance ('not significant') or rejection ('significant') at predesignated 'critical' levels such as 5%. Just for example, in the issue of AJPT in which Johnstone (1995) appeared, there are 14 papers. Of these, nine include statistical hypothesis tests of some kind, and all nine report results as *P* values (one uses a mixture of *P* values and 'significant at 0.05' statements).

9. Rejoinder to Dacey and Ward

Dacey and Ward (1984: 82), like DeGroot et al. (1986) in reference to the evidential needs of courts, reject N-P theory as logically unable to answer the questions users ask (e.g. 'Does the sample make us reasonably certain that H_0 is true?'), unless, of course, by being misinterpreted (e.g. by interpreting $\alpha = p(k \geq k_c|H_0)$ as $p(H_0|k \geq k_c) = \alpha$); cf. Dacey and Ward, 1984: 67). In this, Dacey and Ward are as abject in their criticism of N-P as any Bayesian; not, however, on grounds which lead to their advocating a Bayesian solution. To the contrary, the Bayesian framework is rejected as also inappropriate to the needs of auditing:

> 'The Bayesian method of attestation is a direct application of the subjectivist view of inference and decision to auditing. It consists of two parts: (1) an inference process based upon Bayes' theorem as a means to revise subjective probabilities and (2) a decision process based upon the Bernoulli principle of minimising expected loss. Bayesian inference, consistent with the behavioralist view, ends in the assignment of probabilities to hypotheses. The decision process utilises these probability assignments, as discussed below, to resolve the auditor's practical decision problem of selecting an audit report.
>
> '...The fundamental criticism of the Bayesian method of attestation is its inability to lead to professional opinions (that is, reporting judgments). The auditor requires an inference process that leads to a judgment about the fairness of the financial statements under investigation. The subjectivist Bayesian methodology, however, is overtly concerned with making decisions, not with making judgments.
>
> '...via the Bernoulli principle, the subjectivist Bayesian method leads directly from the assignment of personal probabilities to hypotheses, then to the selection of an optimal report. But such a report cannot reveal the auditor's judgment about the fairness of the financial statements under investigation, because the inference process yields no such judgment' (Dacey and Ward, 1984: 71–4).

This argument begins agreeably with the distinction between Bayesian inference or belief revision (calculation of posterior probabilities) and Bayesian decision-making (the use of posterior probabilities and loss functions to find the action with least expected loss). Having drawn this distinction, which is fundamental to Bayesian statistics (e.g. Lindley, 1972: 9), Dacey and Ward (DW hereafter) proceed to overlook the possibility of Bayesian inference as an end in itself. They argue that Bayesian statistics are concerned only with decision-making when what the auditor needs is an inference process. To a Bayesian, this criticism is remarkable in that it picks on one of the strongest points of Bayesian statistics, this being the facility within the Bayesian framework for ***either inference or decision***. Much Bayesian analysis, especially in research contexts, is only about inference, and in this mode Bayesian statistics are well suited to the needs of the auditor who wants some formal evidential basis on which to form a judgment about the fairness of accounts. In making this judgment, the auditor will consider how the observation of certain data affects the probability of some hypotheses (e.g. the hypothesis that an account balance is materially correct, or that a population error rate is sufficiently low). Bayesian statistics allow and encourage considerations of this kind, whereas classical statistics do not. This is why the DW criticism is so unexpected and hard to fathom. Bayesian statistics are tailor-made for inference, and just because they can also be extended to decision-making if the user is willing and able (has the loss functions required) to go so far formally, is hardly reason to deny or denigrate their inference (i.e. inference only) capability.

If we are to give due consideration to the DW (1984) criticism of Bayesian statistics, we must ask what these authors could have been alluding to when they argued, contrary to so much Bayesian literature and their own clear identification of the dual (inference and decision) dimensions of Bayesian statistics, that the Bayesian framework is only about decision-making, and cannot be used to aid audit inference. The clue to this mystery appears when we examine DW's preferred framework, the 'epistemic approach', observing what it has that the Bayesian approach doesn't. The answer is immediate—the epistemic approach amounts to Bayesian inference (revision of the probabilities of hypotheses by way of Bayes' theorem) with one characteristic modification, this being the addition of a formal 'rule of acceptance' on which the user can *decide* which of the hypotheses tested to believe:

> '...the auditor's inference problem is viewed as one of epistemological decision-making. That is, on the basis of evidence [assessed using Bayes' theorem], the auditor is to select from a class of hypotheses one hypothesis considered worthy of belief. There are as many acts available as there are hypotheses and the i^{th} act consists of accepting as worthy of belief the i^{th} hypothesis, and thereby automatically rejecting all other hypotheses' (Dacey and Ward, 1984: 75–6).
>
> '...an epistemic method of attestation consists of two processes—inference and deci-

> sion. The decision process relates the beliefs arrived at via the inference process to the selection of an audit report. If the auditor infers that the financial statements under investigation are materially accurate, he/she simply reveals that belief in his report. Similarly, if the auditor infers that the statements are materially inaccurate, he/she either seeks an adjustment or reveals that belief' (Dacey and Ward, 1984: 81).

The notion of 'deciding what to believe', given a quantitative (here Bayesian) assessment of evidence, by use of a mechanical decision rule, relies on the writings of certain philosophers of science (references are provided by DW). Drawing on this literature, DW consider three possible epistemic decision rules, these being described succinctly by Scott (1984b: 95) as (i) acceptance of that hypothesis H with highest posterior probability, (ii) acceptance of H with greatest surprise content, and (iii) acceptance of all H with adequate posterior probability, greater than 0.5. By establishing some criterion on *how to think* (i.e. on what to believe), rather than *how to act*, the epistemic approach of DW contrasts with both Bayesian inference and Bayesian decision theory.

Bayesian inference generates probabilities, conditioned on data, for each of the hypotheses tested, but does not lead the user to make any qualitative accept/reject (belief) decision. Rather, each of the hypotheses tested (two or more) is left as more or less acceptable (on a continuum) depending on its posterior probability. Under this formulation, if a decision is to be made, it is one of how to behave, not of what to believe, and it is made according to the rules of Bayesian decision theory, upon explicit consideration of the losses which each possible action would present under each possible hypothesis (state of nature). The epistemic approach gives no explicit consideration to these losses, but instead asks the auditor to assert, and work upon the basis of, whatever hypothesis best satisfies the chosen epistemic decision criterion:

> 'The decision process for an epistemic method of attestation is predicated upon the view that the auditor's beliefs will be truly revealed....if, however, the auditor should choose to lie, then the decision process of the epistemic methods of attestation effectively would be replaced by the expected utility framework. [i.e. by a Bayesian decision theoretic framework with a personal loss matrix]' (Dacey and Ward, 1984: 82).

It appears that DW's (1984) claim that Bayesian statistics cannot meet the needs of audit inference is all to do with Bayesian methods not containing any criterion for decision between possible beliefs. DW would seem to have no other complaint with Bayesian probability revision, indeed their epistemic approach embodies just that. It is rather that in Bayesian inference there is no final belief decision between competing hypotheses by a formal 'rule of inductive acceptance'. This is apparently what DW sees as inadequate about Bayesian inference.

The presumption that we can invent mechanical rules on which certain hypotheses are those which we choose to believe (and others are what we do not believe), has appeared in statistics literature in regard to a so-called cognitive interpretation of N-P decision theory. On this interpretation, a result, say 'accept H_0', is taken as a decision to believe H_0. Such interpretations are disparaged in the following comment, well known in statistical philosophy, of the Bayesian decision theorist J.W. Pratt:

> '...we can invent something else to say, but nothing else to think' (Pratt, 1961: 165).

The purposes of this paper do not extend so far as a philosophical discussion of whether we can really decide to, and make ourselves, believe something, and if so whether there is any rule that tells us definitely what to decide to believe. All that is considered here is whether the DW claim that Bayesian inference theory cannot of itself serve the purposes of auditors is correct. Put simply, is it a problem for auditors that Bayesian inference theory concludes with a posterior probability distribution over the class of hypotheses under test, and does not lead to one of those hypotheses being decided upon as that in which the auditor should believe?

Surely the answer to this question is no, and in fact, quite the reverse, since any rigid requirement of categorical acceptance of (belief in) some hypotheses on the basis of one statistical sample could only obstruct rather than assist the auditor in the broader and difficult task of aggregating all sorts of related and unrelated evidence (before ultimately reporting on the auditee's financial statements). For example, it would be of little benefit if a statistical test of details led to categorical acceptance of the hypothesis of no material error, when the auditor, for reasons of other evidence, did not feel great confidence in this hypothesis. In these circumstances, the auditor would, however, benefit from a probabilistic measure of the strength of evidence afforded by the data to the hypothesis of no material error. Then it might be possible, if only informally and subjectively, to weigh up the total evidence concerning that proposition, despite parts of the evidence being contradictory.

If upon an overall evaluation, the auditor remained sufficiently convinced of the account balance in question, a further statistical test might be run, in which case the outcome might be unfavourable to the hypothesis of no material error. An auditor trying to apply the DW epistemic approach would then be faced with having to believe in that hypothesis (because of the first test outcome) and also disbelieve in it (after the second test). Or perhaps this is not right, since after the first test the auditor would have had to believe in the hypothesis of no material error, and hence could not have rationally tested it again, notwithstanding his or her other grounds for doubt. Moreover, the latter would imply that statistical decisions (i.e. the results of statistical tests) translate, without any possibility of further or collateral considerations, into ultimate audit decisions, and we know from Sennetti (1995: 197) that this is just not what is or ought to be the case (see above).

In what is and will likely remain a largely unstructured and subjective aggregation process, auditors assimilate statistical and non-statistical evidence to make judgments on whether they can, with sufficient overall evidential support, proceed to the next audit objective, and, ultimately, to a report on the auditee's financial statements. In this process, a Bayesian assessment of statistical evidence, culminating in a posterior probability distribution, will likely present a far more representative and digestible outcome of a given statistical test than would the binary kind of outcome desired by DW (1984). The overall audit inference process will thus be aided very much in the way anticipated in the following remarks of Cox:

> '...except in such fields as control theory and acceptance sampling [quality control], a major contribution of statistical technique is in presenting the evidence in decisive form for discussion, rather than in providing a mechanical prescription for the final decision. This is especially the case when a single major decision is involved' (Cox, 1978: 45).

If, for example, the auditor is trying to judge whether a certain population has an error rate ρ less than say 10%, it would be very helpful to know that on some reasonably conservative prior distribution as might be appropriate, the posterior probability of this proposition, H_0: $\rho \leq 0.10$, is only about 0.55 (say). This result, although not comforting, is very easy to understand and hence work with, whereas on the DW epistemic approach, the test result would be either categorical acceptance or categorical rejection of H_0: $\rho \leq 0.10$ (depending on the acceptance rule in place). The auditor will be loathe to accept or reject outright. Such an unhedged result cannot be weighed up against other, less absolute (more measured) matters of evidence. If indeed the auditor was to take the DW epistemic result literally, he or she would be bound to a decision (either to believe H_0 or its alternative H_1) which for reasons of the existence of other evidence, cannot be wanted or warranted.

Perhaps to avoid the difficulty of assimilating individual test results and other evidence, Loebbecke (1995) puts a different construction on the DW epistemic approach. He argues that the DW epistemic decision rule (rule of acceptance) is to be applied not to the result of just any statistical test, but to the total audit evidence, that is, the evidence comprising all statistical samples observed in the audit and all other evidential matter.

> 'Under this [the DW] approach, the auditor would select the most believable hypothesis about the financial statements consistent with the evidence gathered. This requires that...evidence gathering continues until the deserving hypothesis becomes clear' (Loebbecke, 1995: 190).

According to Loebbecke's interpretation, the posterior probability distribution on which the auditor makes his or her epistemic decision is $p(\theta|e)$, where θ represents the state of the auditee's financial statements and $e = \{e_1, e_2, e_3...\}$ represents the whole set of evidence items e_i observed. At a minimum the parameter space Θ includes $\theta_1 \equiv$ 'fair' and $\theta_2 \equiv$ 'not fair'. On the basis of the posterior distribution $p(\theta|e)$, and an inductive acceptance rule (e.g. accept the most probable θ) one or other of the possible parameter values θ is decided upon as that in which to believe, and thus to report. This interpretation of the DW argument does not save it from criticism, or explain how DW can consider Bayesian inference as of no aid to audit judgment. Rather, the following points arise:

(i) Given the scope and complexity of almost any actual audit, it is not possible to grasp the entire audit evidence $e = \{e_1, e_2, e_3...\}$ in a way whereby the likelihood function $p(e|\theta)$ can be measured objectively, or even judged, and without knowing $p(e|\theta)$ over Θ it is not possible to arrive mathematically at a posterior distribution $p(\theta|e)$.

(ii) If $e = \{e_1, e_2, e_3...\}$ could be assimilated so as to enable calculation of $p(e|\theta)$ and hence $p(\theta|e)$, then the DW epistemic approach would be applicable, but would reduce to whole-of-audit level Bayesian decision theory with a very particular loss or utility matrix, namely one which represents an 'epistemic' rather than personal measure of utility. The problem of what kinds of utilities auditors should measure or consider in establishing a payoff or loss function, and from whose perspective, is well worth discussion (e.g. Scott, 1984b: 95). This is an issue for those advocating a Bayesian decision-theoretic model of auditing, but the point remains that a Bayesian application need not reach the formal loss function, decision stage to be of use. Instead, the auditor might calculate the probability of some hypothesis much less global than

$\theta_1 \equiv$ 'fair' or $\theta_2 \equiv$ 'not fair' (such as the hypothesis H_0: $p \leq 0.10$ that less than 10% of sales invoices have not been put through clerical checks), on the basis of one particularly relevant item of evidence *ei* (e.g. a statistical sample of *n* invoices), and use this probability informally and judgmentally in the context of other evidence (in the same way as must have always been the case with results of N-P hypothesis tests), as grounds on which to proceed, with reasonable assurance, to a further audit objective.[23]

Loebbecke's (1995) account of the DW argument suggests that the main point of the epistemic decision theoretic approach is that auditors should use epistemic (ethical) rather than personal (self interest) loss functions. There is more, however, to the DW criticism of Bayesian statistics than just this. DW do seem to view Bayesian decision theory as necessarily predicated on personal rather than ethical or 'strictly professional', or other, possible loss functions. But more to the point of this discussion, DW assert that Bayesian decisions made using such loss functions do not rest upon or embody any opinion or judgment concerning the true value of θ:

> 'An appropriate report issued by an auditor who has employed the Bayesian method of attestation would read "on the basis of my investigation, and while I have reached no opinion and formulated no judgment, I have concluded that my own best interest is served by stating that the financial statements which I examined fairly present...' (Dacey and Ward, 1984: 74).

If such a report as this was designed to describe the application of N-P (strictly 'aevidential') decision theory, then it would be quite appropriate,[24] but the suggestion that a Bayesian decision, whatever the loss or utility perspective applied, does not involve formation of opinion (beliefs) or judgment cannot be allowed to pass. The first step in any Bayesian decision analysis is Bayesian inference; i.e. the revision of personal probabilities concerning θ given the evidence. The inference process is all about the formation, and then reformation (based on newly observed data), of opinion; that is, of opinion concerning the likely value of θ. Subjective Bayesian inference is by nature all about opinion, and of course has always been criticised by 'objectivists' for just that. When a Bayesian decision-maker comes to a decision, that decision is based on his or her revised opinion or beliefs, as represented by a personal probability distribution. There is nothing to prevent the decision-maker expressing this opinion 'without fear or favour', if that is what DW would suggest. The issue of what a professional should say when being of a particular opinion is given rightful attention by DW, but these authors' suggestion that a Bayesian practitioner makes decisions without first, or ever, forming opinions is not an accurate representation of the Bayesian standpoint.

9. Conclusion

Auditing practitioners, and perhaps also most auditing theorists, may foresee little satisfaction or even benefit in the study of philosophical and logical foundations of statistical hypothesis tests. This same aversion is felt by many statisticians toward the philosophical writings of even the most preeminent statistical theorists, including those such as Fisher and Neyman, whose technical contributions are revered. Even among those also numerous statisticians disposed receptively toward discussion of statistical issues at a deeper than merely technical (mathematical) level, there is fundamental disagreement over the motivation for such considerations. At one extreme there is a moral view that exponents of any science are duty bound to understand and not disregard or exceed the foundations of their field. Fisher (1966: 2), who is widely regarded as the greatest of statisticians, and who developed more of the practical methods of classical statistics than any other individual, was one who took this view. And similarly:

> 'In applying a particular technique in a practical problem it is vital to understand the philosophical and conceptual attitudes from which it derives if we are to be able to interpret (and appreciate the limitations of) any conclusions drawn' (Barnett, 1975: 271).

From a less idealistic and more pragmatic stance, statistical theorists such as Lindley (1986) take the position that foundational considerations (the philosophy and logic of statistics) are interesting and relevant to the extent, and perhaps only to the extent, that they affect (improve) professional practice and practical outcomes.

If philosophical argument can in fact lead to changes in statistical practice and outcomes, then even the most 'practical' of users, who want only sufficient tools and understanding to get a job done, will inevitably be concerned. It is worth enquiring, therefore, whether consideration of statistical foundations can indeed lead to any real, and not merely semantic, difference in the way practitioners interpret and justify statistical results. The results presented in this paper suggest that in the context of statistical compliance tests in auditing, and in the interpretation of hypothesis tests generally, the substantive conclusions reached, and not merely the ways these are expressed, do depend on whether the auditor adopts a Neyman-Pearson, Fisherian or Bayesian formulation.

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[23] This is apparently the philosophy underlying the development and justification of Bayesian audit sampling methods in Steele (1992).

[24] N-P directed that the error probabilities (α, β) of a test be determined after consideration of the relative costs of errors of Types I and II. If the auditor considered only personal costs and followed N-P strictly on test interpretation, then the form of report put here by DW would be completely appropriate.

Differences are readily apparent between Bayesian and either N-P or Fisherian outcomes, and, even between these rival 'classical' schools, real differences arise. For example, if an N-P hypothesis test of maximum $\beta = p(\mathit{accept}\ H_0|H_1)$ equal to 0.05 rejects $H_0: \rho \leq m$, then the Fisherian P value measured on H_1: $\rho > m$ is in the interval (0.05, 1],[25] and hence although the N-P test says that H_0 is 'rejected', Fisher's logic implies that, depending on the actual P value observed, H_1 (not H_0) may be the hypothesis discredited. This would be the logical Fisherian conclusion if the observed value of P, measured against H_0, was say 0.051 or some other very low value. The Bayesian logic supports Fisher, in that as a class, results with P values in the interval (0.05, 1] certainly do not all have the same Bayesian interpretation, contrary to N-P. But Bayesians do not agree with Fisher on what a particular value of P (say 0.051 or 0.510) in fact means; in particular, contrary to Fisher's interpretation of P levels, P of say 0.051 is found to mean one thing with small n and quite another with large n. It is in these circumstances of genuine contrariety, at a practical level, that foundations most obviously matter.

It would be perhaps understandable if auditors were to prefer that foundational issues regarding statistical sampling methods were not to be their responsibility. These are, after all, specialist methods introduced into auditing from statistics, and it is therefore statisticians who are primarily responsible for whatever are their strengths and weaknesses. Unfortunately, however, the debate in statistics over foundations has not been resolved to the point where unambiguous guidance can be expected. What has occurred in statistics, being perhaps the next best thing, is very extensive comparative analysis, mutual criticism, introspection, and cross-pollination between the competing classical, Bayesian and various less well known alternative theoretical schools. This has been a necessary and productive intellectual interchange, and has affected the theory and practice of statistics in ways which statistical sampling reference works in auditing have yet to catch up on.

In particular, the debate in statistics concerning hypothesis tests has been most acute, and has induced a shift in statistics textbooks and practice away from the N-P predesignated (α, β) *decision theoretic* formulation, toward a more Fisherian (and thus also more Bayesian) *evidential* model, at least in regard to scientific and other evidence gathering contexts (e.g. empirical research, legal inference, etc.) as opposed to inspection sampling and similar automated decision contexts (e.g. industrial quality control):

> 'In applications, there is usually available a nested family of rejection regions, corresponding to different significance levels. It is then good practice to determine not only whether the hypothesis is accepted or rejected at the given significance level, but also to determine the smallest significance level $\alpha = \alpha(x)$, the *significance probability or p-value*, at which the hypothesis would be rejected for the given observation. This number gives an idea of how strongly the data contradict the hypothesis... significance probabilities, with the additional information they provide, are typically more appropriate than fixed levels in scientific problems, whereas a fixed predetermined α is unavoidable when acceptance or rejection of H implies an imminent concrete decision' (Lehmann, 1986: 70–71).

There has also been a very significant Bayesian lobby, resulting in what Good (1976: 126; 1981: 169) calls the 'Bayesian influence on significance testing'. This influence is undeniable, and manifests itself in even the most authoritative text of the N-P school, Lehmann (1986: 125), including an example and statement of Lindley's paradox (this is also the text quoted above on P levels versus α levels). Remarkably, the theory of statistical sampling in auditing, as represented in reference works including Arens and Loebbecke (1981), AICPA (1983) and Guy et al. (1994), exhibits almost nothing of the Bayesian, or even Fisherian, influence apparent in high level classical statistics references such as Lehmann (1986) and Cox and Hinkley (1974).

Proponents of N-P hypothesis tests and other classical methods in auditing may be comforted by the thought that they do not have to utterly eschew the N-P framework if they are to acknowledge and learn from Bayesian ideas. As has occurred in statistics itself, advocates of the N-P and Fisherian paradigms can modify or moderate their use of classical methods to account for at least some of the Bayesian critique. If this were understood, Bayesian logical and philosophical critique would likely be better received, particularly by those auditors who have been committed from the start to the N-P framework, and auditing as a discipline would be in a position to benefit from the same evolutionary methodological development as has benefited statistics as a whole.

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[25] Here we are assuming the same (unconditioned) sample space in both the N-P and Fisherian tests.

Appendix

Let k denote the number of errors in a sample of preset size n from a population with the error proportion ρ. In a test of $H_0 : \rho \leq m$ against $H_1 : \rho > m$ $(0 < m < 1)$, H_0 is rejected (H_1 accepted) if $k \geq k_c$. If k_c is determined such that the Type II error probability $p(k < k_c | \rho > m)$ is no greater than $p(k < k_c | \rho = m) = \beta$, then the posterior probability of H_0 given data $k = k_c$ (marginal rejection of H_0) approaches $1 - \beta$ as n increases.

Proof: The sampling distribution of k given $\rho = m$ is binomial with mean nm and standard deviation $\sqrt{nm\,(1-m)}$. With increasing n this distribution becomes approximately normal with those same parameters. Hence, the value of k_c which fixes $p(k < k_c | \rho = m)$ equal to β is approximately $nm - Z_\beta \sqrt{nm\,(1-m)}$, where Z_β is that constant with $\phi(-Z_\beta) = \beta$, $\phi(\cdot)$ representing the standard normal distribution function (e.g. $\phi(-1.6400) = 0.05$ etc.)

Now assuming that ρ has a beta prior distribution with parameters a and b, the posterior probability distribution of ρ given data $k = k_c$ is also beta, with parameters $(a + k_c)$ and $(b + n - k_c)$. As n increases, $k_c = nm - Z_\beta \sqrt{nm\,(1-m)}$ approaches nm, since $\sqrt{nm\,(1-m)}$ becomes small relative to nm. Both beta parameters are then large, provided m is not extremely small, and hence the beta posterior is approximately normal. This distribution has mean

$$\frac{(a + k_c)}{(a + k_c) + (b + n - k_c)}$$

approaching k_c/n as n increases, and standard deviation

$$\sqrt{\frac{(nm - Z_\beta \sqrt{nm\,(1-m)}\,)[n - (nm - Z_\beta \sqrt{nm\,(1-m)}\,)]}{n^2(n+1)}},$$

which for increasing n is approximately

$$\sqrt{nm\,(n - nm)/n^3} = \sqrt{m\,(1-m)/n}.$$

Hence, the posterior probability of $H_0 : \rho \leq m$ is:

$$\phi\left(\frac{m - (nm - Z_\beta \sqrt{nm\,(1-m)}\,)/n}{\sqrt{m\,(1-m)/n}}\right)$$

$$= \phi\,(Z_\beta)$$

$$= 1 - \phi(-Z_\beta)$$

$$= 1 - \beta.$$

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Book Reviews

Corporate Environmental Accounting. *Stefan Schaltegger with Kasper Müller and Henriette Hindrichsen.* Chichester: John Wiley 1997. xi + 299pp. £40 hardback.

The growth in interest and activity in environmental accounting in the last 10 years has been little short of astonishing. From a subset of the much-unloved social accounting at the beginning of the decade, it has expanded to become something of a specialism in its own right, so much so that it is no longer possible to keep abreast of, almost daily, new developments. These include financial accounting and the environment; the profession's pronouncements thereon; environmental management and management accounting; environmental reporting; accounting and sustainability; taxation and so on, as well as the increased (welcome although unsupportive) attention of, amongst others, the critical theorists.

One manifestation of this has been the recent emergence of more specialist—and often idiosyncratic—texts on the subject. In a development oddly reminiscent of the early development of social accounting in the 1970s, we find authors offering individualistic attempts to present 'holistic' systems of environmental accounting that spring from the womb, it would seem, fully grown. This is one such text.

The preface to the text is provided by Eiichi Shiratori, former chairman of the International Accounting Standards Committee. This somewhat sets (part of) the tone for the book in claiming that the text provides 'the first comprehensive overview of the emerging field of environmental accounting' and thereby 'sets a standard' (p.xi). This immodesty of claim—apart from being one I find puzzling—is echoed in the foreword and is a constant theme of the text. This is not a shy book. Neither, in my own view, is it especially well-connected with existing themes in the subject. I make this point at the outset because I do not find it especially easy to engage with this book. Consequently, occasional hints of frustration may mar the pursuit of even-handedness in what follows.

The text is organised around four sections. Part A comprises two chapters which set out the 'integrated framework' and 'conceptual centrepiece' (p.1) for the ensuing discussion. Employing a somewhat functionalist interpretation of stakeholder theory from which is derived an explanation for why environmental accounting is an 'economically rational' (p.10) thing to do, the text provides a detailed categorisation of both stakeholders and the types of environmental accounting that they need. Here, the author makes an interesting distinction between two major elements of environmental accounting, which he terms 'environmentally differentiated traditional accounting' (which operates around much that we know as GAAP and management accounting in financial units) and 'ecological accounting', which relates to accounting in physical (non-monetary) units.

The distinction is, of course, an important one. The appropriation of the term 'ecological accounting' in an English-speaking forum, however, will be confusing as it means something quite different to us. In a Germanic and eastern European context, the term is in keeping with wider usage.

At this point a key feature of the text becomes apparent. The thesis developed throughout the book is essentially (if the typification is not too trite) in the Germanic and eastern European tradition of the 'engineering' school of accounting. This approach makes the text less comfortable for the Anglo-Saxon reader.

Part B considers traditional accounting and the environment and comprises four chapters. These chapters are sound reviews of, particularly, the impact of environmental issues on financial and management accounting and what those branches can do about it. Although presented in a rationalist economic setting, the text has good international linkages, especially to North America, and offers a good coverage of the issues. Indeed, Chapter 6 on taxation is especially valuable, as there has been very little authoritative material written on the environment and tax from an accounting perspective. This chapter can be recommended with confidence.

The interest—and novelty—of the book begins to pick up in Part C. Four chapters offer an intense, careful, and detailed appraisal of the role of 'ecological accounting' in a scientific management of environmental impact. The section adopts a precise focus on the technical meaning of eco-efficiency in which precise tracking of environmental activities and the rigorous application of impact assessment and life-cycle analysis offer control tools for an economically rational management. This section provides the notions and tools with which the eco-controlling of Part D is concerned. In this final section the previous ideas of the traditional and ecological accounting systems are fully integrated to provide a complete corporate environmental management system.

These two sections are the tour de force of the text—dense, precise and breathtaking in their rigour. Imagine an elaborate and apparently robust engineering structure of tools, calculations and firmly bolted-together elements from environmental management, accounting, business economics and scientific management. We are led to see, within this rigid cage, the environment captured and controlled and once more where it belongs—within the firm grip of the captains of industry. It defies my powers of synthesis and leaves me somewhat bewildered and dismayed.

This is not a book for deep-greens, feminists or critical theorists of a nervous disposition. However, there is little question that both accounting and environmental management are developing differently in countries such as Germany, Austria, Switzerland and, to a lesser extent, Poland and Russia than they are elsewhere. This book gives a deep insight into that approach—as much by what it ignores as by what it deals with. If the (scientific) managerialism, the frequent assertiveness and the intermittent inaccuracies and rather dismissive tone towards everybody else's attempts to provide environmental accounts can be ignored, the text is almost certainly worth a look. It is certainly challenging and, although it brings me out in a cold sweat, its comprehensive, precise and integrated approach is bound to find friends.

CSEAR, University of Dundee Rob Gray

Comparative Studies in Accounting Regulation in Europe. *John Flower and Chris Lefebvre* (eds). Uitgeverij Acco, Belgium, 1997. 13–431pp. BFr1.450.

This book is described by the publishers as presenting: 'a series of research studies on particular aspects of the national systems for the regulation of financial reporting in the countries of the European Union...their focus is on the analysis of the system that sets these rules rather than on their content...'

It is one of two collections arising from a research network coordinated by the Centre for Research in European Accounting (of which John Flower is director), and financed through the EU. This project had the twin objectives of assisting the career development of 'young researchers' and of the research on national regulation systems itself.

I had hoped to be able to review both collections together, but the second volume, described in the present text as McLeay, S. (ed.) (1997 forthcoming), *The Politics of Accounting Regulation in Europe*, was (summer 1997) described by its editor as (1998 forthcoming) *Accounting Regulation in Europe*. The distinction between the two collections, especially given the largely common authorship, is not clear, and neither, at times, is the focus of this present volume.

The book is topped and tailed by 'introduction' and 'synthesis' chapters (numbers 1 and 13) by John Flower. Chapters 2 to 9 generally adopt a comparative approach, but very much at a subset level. We have effective but straightforward comparisons of Belgium and the Netherlands, and of Denmark and the Republic of Ireland. Michael Power (young researchers?) contributes a perceptive little chapter comparing the influence of academics in the accounting policy process in Germany (high) and 'England' (low), and David Neal an erudite historical and theoretical survey applied, perhaps over-briefly, to Greek accounting regulation.

The next four chapters form a slightly more coherent group focused on southern Europe. We have a comparison of France and Spain by a French author, a comparison of Italy and Spain by a Spanish author, a 'French view' of Italy and finally a comparison of Italy, France and Spain by an Italian writer. All these chapters contain detailed material about accounting regulation methods, models and processes in the countries concerned, and all are interestingly coloured by the authors' cultural backgrounds and 'baggage'. They thus provide considerable factual and attitudinal raw material for a deeper synthesis and a broader overview. The achievement of these, however, is left to the reader.

The next three chapters are rather different. They are all by Gabi Ebbers. She takes three topics: fixed asset revaluation, foreign currency reporting and de facto and de jure criteria for defining a group. Each topic is explored from a regulatory perspective, including proper theoretical foundations, across 11 EU member states, based, says Flower (p.46), on reports by other network members, including those to appear in the McLeay volume. Effective summary comparative tables are provided. Finally, for each topic, she gives and discusses the results of her investigation of the published financial statements of over 200 European multinationals, offering cross-country comparisons for 1987 and 1993. Very significant diversity is found for all three topics. These three chapters are both interesting and impressive, despite (or perhaps because of) their greater emphasis on content of regulation rather than system of regulation.

Chapters 1 and 13, both by John Flower, provide some elements both of factual context and of attempted synthesis. A 'general model of the regulatory system' is given in Chapter 1 and discussed and applied in Chapter 13. A trilateral model based on the framework in Puxty et al. (1987) is proposed and developed, supported by 'percentage influence' calculations, which are plausible in spirit but dubious in detail. What is wrong with overt subjectivity? Chapter 13 explicitly indicates that it is essentially a synthesis of the reports in the McLeay volume, rather than a synthesis of the papers in the present book (p.369).

In conclusion, I make four points:

1. The cultural, academic, conceptual and linguistic abilities generally displayed by the 'young researchers' are very impressive. This bodes well for the development and extension of European and international accounting research.
2. If there is a general message from these explorations, it is that, in my personal view, differences exist for damn good and often deep-seated reasons. Would-be standardisers take note!
3. No attempt whatever is made at any possible normative implications or suggestions (a fact which Karel Van Hulle publicly objected to during a panel discussion on the project at the European Accounting Association 1997 Congress).
4. Considering this volume as an entity in its own right, it is difficult to find any real focus. As a source of 'facts' it is interesting and relevant, but unrigorous. As a comparative study it is incomplete and haphazard in its coverage. Only perhaps as evidence of pros and cons of possible European *research methods* is it essential reading. The parts are interesting in their sometimes esoteric ways. But the whole is not greater than the sum of the parts.

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University of Hull David Alexander

Fairness in Accounting. *Janice Monti-Belkaoui and Ahmed Riahi-Belkaoui.* Quorum Books, 1996. xii + 180pp. £51.95.

This is the latest (although by the time this review appears, it will probably be only one of the latest) in Ahmed Riahi-Belkaoui's very substantial oeuvre. It was co-authored with Janice Monti-Belkaoui, although, confusingly, the anonymous preface is written in the first person singular. In fact, 40% of the text comprises material by other authors which has already appeared elsewhere: the longest of these, specimen accounts illustrating the additional disclosures recommended by the US Jenkins Committee in 1994 and included in the report of that committee, contributes nearly 20% of the length of the book. This may make the volume look more than a little pricey to prospective purchasers.

The first chapter examines the current role of the criterion of fairness in financial reporting: as a test applied to presentation. Both the US 'present fairly' and the UK 'true and fair view' are analysed and it is argued that, while fairness in presentation might in principle be held to mean neutrality, in practice the criterion is interpreted to mean compliance with GAAP, though little evidence for this conclusion is offered other than the authoritative literature of the two countries, and in neither case does the literature actually say this. It is argued that the unfortunate consequences of this position include earnings management, fraud, failure to look to distributive justice and failure to expand disclosure. Nothing is said about how a reformed concept of fairness as neutrality could overcome earnings management and fraud, but the next two chapters of the book are devoted to what are explicitly stated to be the 'more interesting notions' (p. xi) of fairness of distribution and of disclosure.

The second chapter briefly outlines three approaches to distributive justice: those of Rawls, Nozick and Gerwith. Interesting as these are in themselves, little is said about how they might be brought to bear specifically on the accounting world: only two and a half pages are devoted to this and of these, one is taken up with a demonstration that a Nozickean approach has no meaning in the context of distributive justice. As an example of the level of generality of what is said about distributive justice in the accounting world, consider:

> 'Accounting may be called on to facilitate a drastic redistribution of wealth and an effective exercise of the fundamental rights to freedom and well-being of the stakeholders in organisations.' (p. 66).

The following chapter looks at fairness of disclosure, asserting (without argument) that this requires *additional* disclosure, and rapidly moving on to a number of themes that have featured in earlier works by Professor Riahi-Belkaoui, including, for example, value-added and human resource accounting.

The fourth and final chapter switches focus to management accounting and reports the results of a laboratory-game experiment using student subjects to examine unit management behaviour in competitive intra-firm resource allocation. The behaviour (tactics) of the subjects differed according to the ethical framework to which they were steered in the instructions supplied for the game, despite the fact that they were actually rewarded in cash on the basis of the outcome of the tactics they employed, that is, they suffered in cash as a result of behaving ethically. Whether this behaviour would survive careful reflection on the relationship between tactics and outcomes, or be reproduced by actual unit managers is, of course, a matter for speculation.

While the topic covered by this volume is of considerable interest, neither the analysis of fairness as currently employed nor the examination of how it might be applied in future carry the argument sufficiently far to justify its price for individual, or—in these cash-strapped times—library, purchase.

The referencing is rather slipshod. Two contrasting definitions of true and fair view emanating from British academia and published in the same year are both attributed to T. A. Lee when one is, of course, the work of G. A. Lee. This error is repeated in the bibliography and may have alarming consequences for our US colleagues' beliefs about the ability of individual British academics to hold conflicting opinions simultaneously—thereby confirming the old joke about economists. An error in citing the most recent US Statement on Auditing Standards to address the meaning of 'present fairly' means that, although it is quoted twice, it appears in neither the references nor the bibliography.

University of Kent at Canterbury Brian Rutherford

Accounting, A Multiparadigmatic Science. *A. Riahi-Belkaoui.* Quorum Books, 1996.

The author of this book claims that it serves two purposes: 'First, as a guide to the accounting literature and for a better understanding of the principles differentiating the researchers in accounting, and second, as a textbook to be used in research methodology and accounting theory courses' (p.xii). It approaches this difficult task by offering an initial chapter which explores the nature of accounting as a social science, followed by five chapters each of which addresses a different accounting research paradigm identified by the author.

These paradigms are described respectively as the anthropological/inductive, the true income/deductive, the decision usefulness/decision maker/aggregate market behaviour, and the decision usefulness/decision maker/individual user paradigms.

The scope of the book, embracing the whole of contemporary accounting research, inevitably raises high expectations, and it is perhaps therefore unsurprising that the contents prove to be a disappointment. The essential reason for this is that the style of the book is that of an inventory, or even a collage, of accounting research, rather than a well-thought-out and critical guided tour—as provided, for example, in two recent works by Mattessich (1995 and 1996). In many cases this leads to the presentation of summaries, abstracts or quotations from the literature, with little explanation of the meaning or content and virtually no critical commentary by the author. For example, Ohlson's valuation model is expounded in one sentence and one equation (plus notation) (p. 132) and option pricing is given less than one page. Thus, the reader is left to form an opinion on the material, but the exposition is not full enough to provide an adequate basis for this.

This deficiency is compounded by an extremely high number of errors of exposition which, one assumes (or hopes), are the result of shoddy proof reading. This leads to some errors which are faintly ridiculous (such as 'mush gift-giving', p.21, or 'the arbitrary pricing theory (APT)' p.126) and some which are irritating, such as errors in the notation of equations. On other occasions, the errors are positively misleading, such as 'exit' instead of entry price on p.69 or an item in Table 3.6 (model 3, final column), which states precisely the opposite of what is intended. There are enough expository errors to make the book a minefield for students and to have ruled out its use for the author's second objective (use as a textbook), even if the content had been of a higher standard.

Despite the expositional errors and the condensed nature of the text, it is clear that the author's understanding of the literature to which he refers is not always precisely correct. For example, he wrongly implies (p.85) that the gearing adjustment in the UK's SSAP16 applied to all holding gains, whereas it was confined to realised holding gains. Also, he states (p.108) that 'R.N. Marris' (presumably an approximation to R.L. Marris) 'showed that companies acquired are those that are undervalued by the market'. The Marris book was a theoretical rather than an empirical study and *predicted* rather than *showed* this result: this is an important distinction which should be made clear in a book that purports to provide a guide to the methodology of the subject.

There is also scope to disagree with the author's classification of the literature under five paradigms, although here the disagreement may be more a function of personal tastes. For example, Ijiri (Iriji as he is described on p.36), Hatfield, Littleton and Paton are grouped together with Watts and Zimmerman under 'The anthropological/inductive paradigm'. In other words, the suppliers of 'excuses' (the inductive theorists who have sought to derive 'normative' accounting theories from practice) are grouped with the students of the 'market for excuses' (the 'positive' theorists, who dismiss 'normative' inductive theory as mere excuses, supplied in response to the demands of self interest).

Despite these criticisms, it would be wrong to imply that there is nothing worthwhile in this book. It does provide an inventory of a wide range of contemporary accounting research, and it will be an exceptionally well-informed reader who does not find anything new in it. For the reviewer, the most informative chapter in this respect was Chapter 6, which deals with behavioural accounting studies (described, in the cumbersome style of the author, as 'the decision usefulness/decision maker/individual user paradigm'). This may be because the author has contributed particularly to this area of research. On the other hand, it may be because the reviewer was least well informed in this area and therefore least well equipped to criticise.

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Mattessich, R. (1996). 'Academic research in accounting: the last 50 years'. *Asia-Pacific Journal of Accounting*, 3 (1): 3–81.

University of Cambridge Geoffrey Whittington

Forty Years of Normative Portfolio Theory: Issues, Controversies and Misconceptions. *George M. Frankfurter and Herbert E. Phillips*. JAI Press Inc., Greenwich, Connecticut, Contemporary Studies in Economic and Financial Analysis, Volume 76, May 1995. 146pp.

This book is a dissenting work that is a labour of love and dismay. The authors believe in diversification as a normative maxim and, as academics nearing the end of their careers, feel compelled to speak out against 40 years of systematic and wilful distortion. It has the twin themes that the original normative Markowitz portfolio theory model has been subverted to become a positive model, and that the Bayesian aspects of this model have been ignored. This transformation, which was part of the expulsion of normative theory from the literature of finance, was accomplished by the princely assembly of model builders who were in control of the editorial policies of the major academic journals.

Harry Markowitz accepted the 1990 Nobel prize for acquiescing to the death of normative theory, and William Sharpe for its resurrection as a positive theory of asset pricing (CAPM). Indeed, the normative application of the CAPM is impossible, and the myriad empirical works that masquerade as applications of the CAPM are, in fact, misrepresentations. In real world applications, the Markowitz model (and CAPM) is only applicable to the stock market, and cannot encompass bonds, real estate, moon rocks, baseball cards, works of art, etc. Furthermore, the APT is a theory in search of a valid statistical methodology, without which it will continue to be quite useless.

In similar vein, the authors criticise the work of the great and the good—William Baumol, William Breen, Edwin Elton, Eugene Fama, Kenneth French, Milton Friedman, Martin Gruber, Eugene Lerner, Harry Markowitz, Stewart Myers, Richard Roll, William Sharpe, the lawyers who drafted the US 1974 ERISA Act, and textbook authors. They also state that a number of well known academics have enhanced their personal finances by selling beta estimates.

The parameters (means, variances and co-variances) needed before the Markowitz model can be solved are not known with certainty—they must be estimated (termed estimation bias). However, optimisation models, e.g. the quadratic programming used in solving the Markowitz model, are deterministic in that they treat all inputs as known with certainty. Casual application of the law of large numbers leads many to mistakenly suppose that the rules of averaging apply in this case, i.e. the estimation errors tend to cancel out, and the optimal solution is, on average, unaffected by estimation errors. This is wrong, because an optimisation algorithm does not assign weights at random to the data. Securities whose mean return is over-estimated, or whose variance of returns is under-estimated, will be over-represented in the optimal solution. This problem is termed selection bias.

Over the past quarter of a century, Frankfurter and Phillips et al. have investigated the effects of the lack of certainty of the parameters of the Markowitz model, and their work is summarised, including the simulation of the full co-variance model, and a comparison of the full co-variance approach with Sharpe's single index model. Frankfurter and Phillips et al. show that estimation risk leads to selection bias, but they offer no solutions to this problem, other than their own proposal for grouping similar securities before the application of the single index model.

This omission is surprising, since there is a substantial literature (e.g. Bawa et al., 1979) on this matter, including work by Markowitz, amongst others. This literature includes alternative ways of estimating the inputs to the Markowitz model other than the simple use of historical estimates, and the introduction of restrictions on the solutions to the Markowitz model to reduce the effects of selection bias.

If the objective of this book is to change the way an established body of knowledge is interpreted, the case needs to be put in a simple, clear and compelling manner. Unfortunately, the authors do not pass this test. As finance books go, this book is most unusual. It is a strange mixture of polemical statements in colourful language, and dry, compressed mathematical recapitulations of utility theory, portfolio theory, CAPM, basic statistics, correlation, regression, and Bayesian statistics.

Any reader who is ignorant of these technical matters would be better off looking at one of the many textbooks on these topics; although the reader is warned that textbooks include a continuously evolving montage of inaccuracies.

While it is a short book, it contains much technical material, and the main arguments could have been more clearly stated in a much shorter, less technical, piece addressed to those who have been misled by the princely assembly of model builders, and so are familiar with the underlying technical material (which is not disputed by this book).

A book containing statements such as 'positive theory is the product of an intellectual culture that treats facts as an abuse of reality' has an idiosyncratic view of positive theories. Although its message depends on the concepts of normative and positive theories, this book does not contain a clear statement of what the authors mean by these terms. Furthermore, the authors fail to demonstrate that it matters whether a model is viewed as normative or positive, or that the same model cannot legitimately be viewed as both normative and positive.

This reviewer's mind has not been changed by reading this book, but then perhaps I have been led astray by the academic journals and the continuously evolving montage of inaccuracies in textbooks which, by constant repetition, take on a life of their own. I hope the authors have obtained a lot of personal satisfaction from writing this book, because I suspect their other rewards will be slight.

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Bawa, V., Brown, S. J. and Klein, R. W. (eds.). (1979). *Estimation Risk and Optimal Portfolio Choice*. North Holland.

University of Southampton Charles Sutcliffe

Accounting and Business Research

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The Role of Resource Accounting in the UK Government's Quest for 'Better Accounting'

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Audit Pricing in the Pension Plan Audit Market

Charles P. Cullinan*

Abstract—The economic determinants of audit fees have been examined extensively among public companies, both in the US (e.g. Simunic, 1980; Gist, 1992) and internationally (e.g. Anderson and Zhégal, 1994). These studies have been based on audits of publicly-traded firms, which were surveyed to determine the audit fees. In the US pension plan audit market, audit fees are publicly disclosed, eliminating the potential for response bias present in most other audit fee studies. Additionally, unlike the public company audit market, the pension plan audit market is not dominated by the Big Six accounting firms, and audit fees in the pension plan audit market are smaller than in the public company audit market. This study examines the generalisability of the audit fee model by applying the model in the pension plan audit context. In accord with other audit fee studies, results indicate that client characteristics, including client size and risk, are associated with pension plan audit fees. In contrast with other studies, findings regarding market factors do not suggest a difference in fee structures between Big Six and non-Big Six firms, and the results indicate that auditor changes do not affect pension plan audit fees.

1. Introduction

Many researchers have examined the relationship between client characteristics and audit fees (e.g. Simunic, 1980; Pratt and Stice, 1994; Anderson and Zhégal, 1994; Gist, 1992). Results have consistently shown that client size, complexity, and risk are associated with audit fees. Audit fee studies have generally relied on surveys to measure the audit fees accounting firms charge to clients, and the samples in these studies have therefore been restricted to survey respondents. In the US, pension plans are required to disclose their audit fee on a publicly-accessible document, thereby removing the potential for non-response bias in an audit fee study. Another major difference between the pension plan market and the public company audit market is that the Big Six accounting firms do not dominate the pension plan audit market.

The purpose of this study is to examine the generalisability of the audit fee model by examining its applicability to the pension plan audit market. The paper begins with a discussion of the audit fee model and its application to pension plan audits. The research method used is then presented, followed by the results of testing the model. The paper concludes with a discussion of the study's results and limitations, and a summary.

2. The audit fee model applied to pension audits

The objective of this section is to discuss the audit fee model and how it can be applied to the pension plan audit market. Audit fee research has identified and examined four main categories of variable that have been shown to influence audit fees: size, opinion type, market factors and risk. Each of these four areas will be discussed, and the way they operate in the pension plan context will be addressed.

2.1. Sales/activity

One factor consistently shown to influence audit fees is the size of the auditee (e.g. Simunic, 1980; Palmrose, 1986; Gist, 1992). The rationale is that larger auditees will require more time and other resources to audit, resulting in a higher audit fee. In keeping with previous research, it is expected that the larger the auditee (pension plan), the greater amount of time the audit will take, resulting in a higher audit fee. Size is measured by total assets of the pension plan.

The nature of pension plans means that certain activities may require additional audit effort and may not be sufficiently represented by a size measure. One major pension plan activity during any given year is the employer's and/or employees' contributions. The plan size variable does not capture this information, because two pension plans of the same size may have differing levels of contributions. For the pension plan with more contributions, more work would be necessary to audit the contributions, resulting in a higher audit fee. The effect of plan size is removed from the contributions measure by using the ratio of contributions to assets. The scaling of variables by size is consistent with other audit fee research (e.g. Anderson and Zhégal, 1994).

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*The author is assistant professor at Bryant College. He gratefully acknowledges helpful comments received from Greg Trompeter, Gail Wright, the participants at the 1996 Northeast American Accounting Association meeting, and two anonymous reviewers. The paper has also benefited from discussions between the author and various officials at the US Department of Labor. Correspondence should be addressed to Professor Cullinan, Bryant College, Smithfield, RI 02917, USA. This paper was submitted in September 1995 and accepted in December 1996.

Asset sales is another pension plan activity that may not be sufficiently represented by size, because asset sales may vary among pension plans of similar size. Some pension plans may employ a buy and hold strategy, while others may be more frequent traders. A turnover ratio, calculated as the proceeds from the sale of assets divided by average assets, is employed to represent this pension plan activity. Greater turnover indicates more asset sales, which require time to audit. Therefore, the audit fee is expected to be positively correlated with turnover.

Another activity measure that could vary in pension plans of similar size is the number of participants. The greater the number of participants, the larger the number of potential transactions involving individual participant contributions to the plan and payments from the plan. This larger number of transactions will require more resources to audit, thereby increasing the audit fee. To remove the effect of plan size from this variable, the number of participants is scaled by plan size.

2.2. Audit Opinion

The type of audit opinion has often been found to influence the audit fee charged to a client (e.g. Francis and Simon, 1987; Gist, 1992). An audit opinion qualification increases time spent resolving and documenting the misstatement, and the time spent attempting to convince the client to modify the financial statements. Thus, one would expect an audit resulting in a qualified opinion to be more costly than an audit resulting in an unqualified opinion. The audit firm may attempt to pass these higher costs to the client,[1] resulting in a higher audit fee.

2.3. Audit Market Factors

Previous research has examined whether 'Big Six' CPA firms have a different fee structure from non-Big Six firms. Simunic (1980) investigated the effects of Big Eight v. non-Big Eight firms on the audit fees charged to public companies. He found no significant differences between Big Eight and non-Big Eight firms for samples of both small and large clients (Simunic, 1980). Palmrose (1986) found that Big Eight firms charged higher audit fees within the small client segment of the audit market. Limited evidence suggested that the higher audit fees for Big Eight firms were a result of the large firms spending more hours conducting the audit, rather than charging a higher fee per hour. Anderson and Zhégal (1994) and Thornton and Moore (1993) discussed rationales both for Big Six firms charging more than non-Big Six firms, and for Big Six firms charging less than other firms. The different conclusions are based on either a higher price per hour charged by Big Six firms, or fewer hours spent conducting the audit due to the Big Six firms' expertise and economies of scale.

Some studies examining the Big Six pricing differential have found that Big Six firms charge more than non-Big Six firms (e.g. Palmrose, 1986; Simon and Francis, 1988). Other studies have found mixed or non-significant differences in audit fees between the Big Six and smaller firms (e.g. Simunic, 1980; Anderson and Zhégal, 1994). Given the divergent results found by previous researchers, and the different potential interpretations of Big Six effects, no directional prediction is made for the Big Six variable.

Simon and Francis (1988) found that when there was an auditor change, the new auditor tended to charge less than the expected fee, *ceteris parabis*, for the first three years the firm had the client. This lower fee structure was assumed to result from competitive pressures and the desirability of obtaining more clients by reducing audit fees. Ettredge and Greenberg (1990) also note the prevalence of fee-cutting by auditors to obtain new clients. Therefore, viewing auditor changes from a marketing perspective, auditor changes would be expected to result in lower audit fees. From a cost standpoint, however, one would expect a first-year audit to be more costly to the CPA firm than a continuing audit. These higher costs result from the greater degree of documentation of the client's business and control structure required for a new client, as well as a learning curve effect of becoming familiar with the client's operations.

Thus, if market forces were the primary influence on audit fees of newly-accepted audit clients, one would expect the competitive process to result in lower fees on initial audit engagements. Alternatively, if a cost-based pricing approach were used by the CPA firm, the audit fee would be expected to be higher for first-time audits. As with Big Six status, a directional prediction is not made for the auditor change variable due to these differing rationales.

2.4. Risk Factors

In general, risk may influence audit fees because accounting firms spend more time and other resources auditing risky clients. Alternatively, accounting firms may charge a higher fee per hour to compensate for the additional risk assumed in the engagement. Pratt and Stice (1994) provide some evidence that both effects are present. Hill et al. (1994: 189) note that: '[A higher audit fee] for higher residual risk can be viewed as a rational response to...risk in a competitive market.' Thus, the relationship between risk and audit fees could result from more audit work being performed, a higher fee being charged to compensate for the risk assumed, or some combination of the two factors. Regardless of the underlying mechanisms, higher risk audit clients would be expected to pay higher fees.

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[1] Deis and Giroux (1996: 70) discuss how auditors may pass the higher costs associated with audit opinion qualifications on to their clients.

Based on an examination of pension audit workpapers, Walker (1996) documents a high degree of audit deficiencies in pension plan audits. He notes that these deficiencies may result from underestimation of 'the complexity of these audits and the risks associated with them' (p. 56). Allen and Auerbach (1996: 2–56) indicate that the US Department of Labor (DoL), which oversees pension plan reporting, has made numerous referrals to the disciplinary authorities at the American Institute of CPAs and state accountancy licensing boards when deficient pension audit work has been found. They also note that the DoL has imposed penalties on plan administrators for deficient audit work. Thus, the institutional environment of pension audits in the US provides the impetus for auditors to ensure that they adequately assess pension audit risks and consider the implications of these risks for the conduct of the audit. The remainder of this sub-section summarises the types of risk addressed by previous audit fee research, and identifies measures of these risks in the pension audit environment.

There are many notions of risk in an auditing context. US professional standards focus on audit risk, which is defined as 'the risk that the auditor may unknowingly fail to appropriately modify his opinion on financial statements that are materially misstated' (American Institute of Certified Public Accountants (AICPA), 1995: §312.02). Audit risk comprises three component risks: inherent, control and detection risks. Audit fee researchers have often incorporated variables measuring the inherent risk component of audit risk.

The US auditing standards note that accounts based on subjective estimates have a high degree of inherent risk (AICPA, 1995: §312.20(a)). Accounts receivable and inventory involve subjective judgments in determining their reported values, and measures of these accounts have often been included in audit fee models (e.g. Simunic, 1980; Beatty, 1993). Thus, inherent risk related to particular accounts has been measured using receivables and inventory variables.[2] Higher dollar values of these accounts (relative to firm size) were hypothesised to result in a greater amount of time being spent on the audit, resulting in a higher audit fee. Results in the literature are supportive of this relationship (e.g. Anderson and Zhégal, 1994; Maher et al., 1992). Inventory and accounts receivable measures of inherent risk are not applied in this study because of the insignificant size of these accounts in the pension plan context.

All assets held by a pension plan must be reported at their 'current value' (Department of the Treasury et al., 1991: 22). Pension plans tend to have a substantial portion of their assets in marketable equity and debt securities for which a current (i.e. market) value is readily obtainable. Some pension plans, however, have invested in assets for which a market value is more difficult to obtain and more subjective, such as joint ventures and real estate assets. One measure of inherent risk in the present study is therefore joint ventures and real estate assets as a percentage of total assets. These joint venture and real estate assets will be referred to in this study as 'hard-to-audit' assets.

The pension plans included in the present study are subject to the Employee Retirement Income Security Act (ERISA). Langbert (1994: 72) notes that one measure of the costs of ERISA compliance is the legal fees incurred by the pension plan. Complex transactions and plan structures require legal assistance to ensure compliance with ERISA. These complex transactions are more susceptible to misstatement, increasing inherent risk. As with other risk measures, the elevated inherent risk increases the audit fee through either more hours being spent on the audit, or the audit firm charging a higher fee per hour. Thus, legal fees (relative to plan size) is a measure of the complexity of plan transactions and structure and is used as a measure of inherent risk in this study.

An additional measure of inherent risk is whether the plan made any amendments during the year under audit. Amendments might include changes to benefits and/or eligibility requirements. Misstatements are more likely to arise during a transition period than during other periods, increasing inherent risk, and therefore audit fees, when plan changes are made. Thus, whether or not the plan instituted an amendment during the year under audit is a measure of inherent risk in this study.

Many pension plans are established as a result of a collective bargaining contract between the sponsoring firm's management and a trade union. Unionised pension plans are administered by an organisation that is separate from the employers providing funding for the plan. Additionally, the union's goals are often different from those of the employers funding the plan. This clear separation and the potentially divergent interests between the union and the funding employers may increase the probability of errors arising as information and funds are passed from the employer to the union-controlled pension plan. This increased probability of errors could affect the cost of the audit and the

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[2] Researchers frequently classified these variables as 'audit complexity' variables, which is analogous to inherent risk as used in this paper.

Figure 1
Variables included in audit fee model

Variable	*Expected sign*	*Measurement method*
Size/activity		
Log of assets	+	Natural log of total plan assets
Contributions/assets	+	Total contributions/total plan assets
Turnover	+	Assets sold/average assets
Participants/assets	+	Total plan participants/total plan assets
Audit opinion		
Unqualified opinion	–	1 if unqualified opinion, 0 if qualified opinion
Audit market factors		
Big Six	?	1 if auditor is Big Six firm, 0 otherwise
First year audit	?	1 if first time audit, 0 otherwise
Risk variables:		
Audit/Inherent risk:		
Hard to audit assets	+	Percentage of assets in joint ventures and real estate
Legal fees/assets	+	Total legal fees/total assets
Amendment	+	1 if plan was amended during year, 0 otherwise
Unionised plan	+	1 if union plan, 0 otherwise
Client financial risk:		
Plan funding	–	Total plan assets/plan liability

audit fee. Therefore, collectively bargained union pension plans audit fees are expected to be higher than other plans.

In addition to audit risk, the US auditing standards also note the existence of a risk that the auditor will suffer 'loss or injury to his professional practice from litigation, adverse publicity, or other events arising in connection with financial statements he has audited and reported on' (AICPA, 1995: §312.01, footnote 2). Researchers have measured this risk using variables associated with the probability of the client experiencing difficulty ('client financial risk').

The client's financial risk is measured in the present study by the level of the pension plan's funding. Under-funded pension plans, in which the actuarial liabilities exceed the plan assets, are more susceptible to financial difficulty than fully-funded pension plans. Funding is measured as the ratio of plan assets to the pension plan actuarial liabilities. Lower funding ratios indicate greater client financial risk, resulting in a higher audit fee. A summary of the variables included in the audit fee model and their measurements is shown in Figure 1.

3. Research method

This section reviews the data used in the study and discusses the types of analyses performed. All US pension plans covering 100 or more employees are required to submit Internal Revenue Service DOL Form 5500 (Department of the Treasury et al., 1991) annually. This form provides information about the pension plan as required by the ERISA. The form contains audited financial statements for the pension plan, information about its nature, eligibility requirements, and other information. Form 5500, Schedule C requires disclosure of the plan's independent accounting firm, and the fees paid to the accounting firm. The Form 5500 instructions note that the fee disclosed could include fees paid to the independent accountant for other accounting services in addition to the audit. As such, there may be a degree of measurement error in this variable.

Data from the 1991 Form 5500 were used in this study. The plans included in the sample are multi-employer defined benefit plans which did not receive a 'limited scope' qualified audit opinion. The sample was restricted to defined benefit plans because funding level, which was one of the variables in the model, is not applicable to defined contribution pension plans. Only multi-employer pension plans were included because single employer plans often use the same auditor as the firm sponsoring the plan.[3] Due to the auditor's relationship with the sponsoring firm, the CPA may not always charge for the pension plan audit as if it were a stand-alone audit. Thus, single employer plans are excluded from the sample. Those pension plans re-

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[3] To examine this proposition, the auditor of 50 single employer pension plans was compared to the sponsoring firm's auditor, as shown in *Who Audits America*. Of these 50 plans, 46 (92%) had the same auditor as the plan sponsor.

Table 1
Univariate statistics

Continuous variables:

Variable	*Mean*	*Standard deviation*
Audit fee	$20,674	$32,948
Total assets	$101,360,000	$227,350,000
Contributions	$3,725,704	$9,034,489
Legal fees	$47,839	$12,867
Hard-to-audit assets	$2,297,747	$16,360,833
Participants	4830	12114
Turnover	62.38%	74.85%
Funding	133.49%	49.63%

Dichotomous variables:

Variable	*Value*	*Number of plans*	*%*
First-year audit	No	1045	94.10
	Yes	65	5.90
Big Six firm	No	999	90.00
	Yes	111	10.00
Union plan	No	58	5.20
	Yes	1052	94.80
Unqualified opinion	No	66	5.90
	Yes	1044	94.10
Plan amended during year	No	117	10.50
	Yes	993	89.50

ceiving a 'limited scope' exemption audit opinion[4] were excluded because the auditor does not audit that portion of the pension plan's assets that are held by qualifying insurance companies. Given the unavailability of data related to the portion of plan assets exempted from audit, the potential effects of the limited scope on the audit fee could not be adequately measured. Based on these restrictions, and missing data points for certain plans, 1,110 pension plans were included in this study.

The analysis begins with descriptive statistics of the variables. The pension audit fee model is then tested using ordinary least squares regression. Consistent with other audit fee research (e.g. Simon and Francis, 1988; Ward et al., 1994), the natural log of the audit fee and the size variables are used in the regression analysis.

4. Results

4.1. Descriptive Statistics

The descriptive statistics are shown in Table 1. The large standard deviations (relative to the means) for audit fee, assets, contributions and participants is indicative of the large size of a certain number of the plans. The average audit fee charged to the plans in this study is $20,675, and the average total assets is $101,360,000. In the Simunic (1980) study, the average audit fee was $206,600 and average assets were $555,100,000 (Simunic, 1980: 179). In a study of the 'small client' audit market (Gist, 1994: 228), the average audit fee and client size were $52,500 and $43,404,030 respectively. Thus, the average pension plan audit fee is smaller than those of other audit fee studies. The audit fee as a percentage of total assets in the current study is 0.020%, while this figure was 0.037% in the Simunic (1980) study, and 0.12% in Gist (1994). This indicates that audits in the pension plan audit market are less costly per dollar of assets than in other audit markets examined.

Only 5.9% of the plans changed auditors during 1991, which is consistent with Palmrose's (1986: 99) finding that 6% of the firms in her sample made auditor changes. With regard to Big Six status, 10% of the pension plans in the sample used a Big Six firm as their auditor.[5] The percentage of audits performed by Big Six audit firms is lower than in most other studies. For example, the percentage of Big Six audits was 72.5% of Simunic's (1980: 169) sample, 38.1% of Gist's (1994: 228) sample of small client audits, and 83% of Palmrose's (1986: 105) sample. Therefore, the Big Six firms appear to have a much smaller market presence in the pension plan audit market than in other markets studied.

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[4] Limited scope audit opinions involve the auditor disclaiming an opinion on a portion of the plan's assets, and are permitted under ERISA (29 CFR 2520.103–8 or 2520.103–12(d)).

[5] The audit firm with the largest number of clients in the sample was Thomas Havey & Co, a CPA firm based in Chicago. Thomas Havey & Co audited 62 (5.6%) of the 1,110 pension plans in the sample. The next most common auditing firm

Table 1 also indicates that 5.9% of the pension plan audits resulted in a qualification in the audit opinion. This percentage is below the 14% qualified opinion rate found by Beatty (1993: 298), 12.7% by Krishnan (1994: 204), 8% by Gist (1992: 81) and 8% by Simunic (1980: 179). Many of the previous studies included 'subject to' opinion qualifications, which the standards no longer allowed at the time of the pension plan audits being studied (i.e. 1991). Results, therefore, may not be directly comparable. Krishnan (1994: 204) provides a breakdown of qualifications in his sample between going concern opinions and other types of qualifications. The non-going concern qualifications comprised 6.6% of his sample. This result is more consistent with the findings in the pension plan audit context.

Certain variables have not been used in other audit fee studies because of their unique applicability to pension plans. For these variables, no comparisons with previous audit fee research are meaningful. Nevertheless, these variables provide some insight into how the pension plan audit market functions. The mean pension plan has contributions of $3,725,704, which represents 3.7% of plan assets. Legal fees average $47,839, while the mean hard-to-audit assets is $2,297,747, which is 2.2% of total assets. The mean plan has 4,830 participants and a portfolio turnover of 62.38%. The mean funding level is 133.49%, indicating that the mean plan in the sample has adequate funding (plans with a funding value below 100% are underfunded plans).

Most of the pension plans amended the plan requirements and/or structure during the year under audit (89.5%). This high percentage may indicate that the variable may mix major and minor changes, and therefore may not effectively measure differences in risk among plans. Most of the plans (94.10%) were unionised. An example of a non-union multi-employer pension plan included in the study is the pension plan administered for the employees of telephone cooperatives by the Nation Telephone Cooperative Association.

4.2. *Multivariate Results*

The regression results for the audit fee model applied to the pension plan audit market are presented in Table 2. The overall model is significant at 0.0001 (F = 50.506; d.f. = 12, 1097), and the adjusted R^2 is 0.39.[6] The t-test probabilities are all one-tailed, with the exception of the Big Six and first-year audit variables, because no directional predictions are made for these variables. Standardised betas are presented to facilitate comparisons among the variables. An examination of scatterplots revealed no heteroscedasticity concerns, and the largest variance inflation factor was 1.69, which indicates that multicollinearity is not a major problem in the model.

The client size variable indicates that auditors charge higher audit fees to larger pension plans, and this relationship is significant at 0.01. The activity measures of plan contributions and turnover were also significant in explaining audit fees. However, portfolio turnover, as a measure of plan activity, was not significant in explaining variation in audit fees. Overall, pension plans of larger size and greater activity were charged higher audit fees. The audit opinion results indicate that audit fees were higher for pension plans receiving audit opinion qualifications. The two variables measuring audit market factors, Big Six status and first-year audit, were not significant in explaining the variability of fees.

The inherent risk variables of plan amendment, legal fees/assets, the percentage of a plan's assets in joint ventures and real estate (hard to audit assets), and unionisation status were all significant at conventional levels and in the predicted direction. These results imply that audit fees are higher for pension plans with higher inherent risk. Client financial risk is also shown to influence audit fees through the significance of the funding variable. The sign of this variable indicates that audit fees are lower for those firms with well-funded pension plans, in which there is less risk of the client experiencing financial difficulties.[7]

5. Discussion

5.1. *Comparison with Previous Research*

The variables found to be significant explanatory factors in this study are those which are client characteristics. The client's size and activity is a

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represented in the sample was Deloitte and Touche, with 30 plans (2.7%).

[6] The R^2 in this study is lower than most others in the audit fee literature. Potential measurement error in the dependent variable resulting from inclusion of non-audit services in the variable may help to explain the lower R^2.

[7] To understand the impact of the risk variables on audit fees, a regression was run with and without the risk variables. The risk factors have an incremental explanatory power (incremental R^2) of 2%, which is less than the 4.4% incremental explanatory power found by Hill et al. (1994: 197) for their risk variables.

Table 2
Ordinary least squares regression results (dependent variable: log of audit fee)

Variable	*Expected sign*	*Regression coefficient*	*Standardised coefficient*	*t-statistic*	*One-tail* $p>t$
Intercept	NA	2.41	0.00	7.44	0.0001
Size/activity					
Log of assets	+	0.37	0.65	23.39	0.0001
Contributions/assets	+	2.79	0.11	4.22	0.0001
Turnover	+	0.02	0.01	0.56	0.2865
Participants/assets	+	397.74	0.07	2.19	0.0145
Audit opinion					
Unqualified opinion	−	−0.17	−0.04	−1.87	0.0309
Audit market factors					
Big Six	?	0.02	0.06	0.22	0.8248*
First-year audit	?	0.05	0.01	0.51	0.6093*
Risk variables					
Audit/inherent risk:					
Hard-to-audit assets	+	1.10	0.06	2.33	0.0100
Legal fees/assets	+	35.84	0.09	4.47	0.0011
Amendment	+	0.13	0.05	1.90	0.0288
Unionised plan	+	0.29	0.07	3.00	0.0014
Client financial risk:					
Plan funding	−	−0.08	−0.04	−1.79	0.0370

F statistic 59.50 (d.f. = 12, 1097)
$p>F$ 0.0001
Adjusted R^2 0.39
Number of observations 1110
*Two-tailed test due to lack of expected sign

characteristic which is likely to affect the cost of the audit because of the increased amount of time spent auditing the transactions. The increased cost would then affect the audit fee. Inherent risk is also a client characteristic that can affect the audit's cost, either through more hours being spent on the audit, or a higher fee per hour being charged to compensate for the greater risk assumed. Both the size and audit risk factors are items known or knowable to the auditor when an audit fee is quoted to the client. The present study's findings are consistent with other audit fee literature that demonstrated an association between client characteristics and audit fees.

The type of audit opinion is also related to the client, in that the client has misstated the financial statements and chosen not to change the misstatements discovered by the auditor. The audit opinion variable was also shown to be an influencing factor on audit fees. As with the other client characteristics, issuing a qualified opinion requires more audit time, increasing the costs of performing the audit. The findings that client characteristics are recognised by the auditors, and that their fees are determined with consideration given to client characteristics, is consistent with previous audit fee research.

Factors not shown to influence audit fees in the pension plan audit environment are those related to the accounting firm, and market forces, rather than to client characteristics. Big Six status had no effect on audit fees. This lack of effect may result from the Big Six's relatively small market share in the pension audit market. Another market force, auditor changes, was found to be uncorrelated with audit fees in the pension context. This result is inconsistent with Simon and Francis (1988), but consistent with the results of Palmrose (1986: footnote 4).

5.2. Limitations

There are a number of limitations that must be considered when interpreting this study's results. First, the variable used to measure the audit fee may include non-audit related fees paid to the independent accountant in addition to the audit fee. Thus, the dependent variable in this study may contain a degree of measurement error.

Second, the overall predictability of audit fees appears to be lower in the pension market than in the public company market. The R^2 is 0.39, which is below the R^2 of many other audit fee models (e.g. Simon and Francis, 1988: 261, report an R^2 of 0.79). One possible explanation is that the audit fees of clients that are established, publicly-traded firms may be more predictable than those of other audit clients. For example, Beatty (1993) sampled a population of mainly small firms undergoing an initial public offering, and reported an R^2 of 0.35 in his audit fee model. Another potential contributing factor to the low R^2 may be the differences between audits of entities engaged primarily in financial activities and those in more traditional industries such as manufacturing. For example, Simunic (1980) and Maher et al. (1992) excluded banks from their audit fee sample because the banks 'were outliers' (Simunic 1980: 180). The sparsity of Big Six auditors in the sample may also indicate that non-Big Six firms' audit fees are less predictable than audit fees of markets in which Big Six firms predominate. The model may also not be sufficiently specified to capture the variation in audit fees in the pension audit market. Finally, as mentioned previously, the variable measuring audit fee may include some fees paid to the independent accountant that were not directly related to the audit.

Another limitation of the study is the difficulty of clearly separating inherent risk and client financial risk. The auditing standards indicate that inherent risk exists for the financial statements as a whole, as well as for particular assertions. The indicators of higher inherent risk for several or all assertions include: 'a lack of sufficient working capital...or a declining industry characterised by a large number of business failures' (AICPA, 1995: §312.20(a)).

6. Summary and conclusions

This paper presented an application of the audit fee model to the US pension plan audit market. Consistent with previous research in non-pension contexts, larger and more active pension plans paid higher audit fees, and audit opinion qualifications resulted in higher audit fees. Similarly, audit fees were higher for pension plans with greater risk. Contrary to previous research, the Big Six firms had only a small share of the pension plan audit market, and the Big Six status of the auditor did not influence the audit fee charged. A change in auditors was also not found to influence the level of audit fee. Overall, results indicate that the audit fee model has applicability in the pension plan audit context with regard to client factors most associated with audit cost (such as size and inherent risk). The application of the audit fee model in a pension environment with respect to factors associated with the audit market (Big Six status, and auditor changes) indicated that audit market factors have different results in the pension market than in other markets. This finding suggests that market factor effects may differ, based on the audit pricing context.

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Discretionary Accounting Choices: A Debt-covenants Based Signalling Approach

Pascal Frantz*

Abstract—This paper seeks to explain the discretionary accounting choices made by managers in a world characterised by asymmetric information between managers and investors. It considers a firm whose capital structure consists of both debt and equity, a manager who protects the interests of the firm's existing shareholders, and a financial market. The manager is committed to engage in an investment opportunity and needs to raise some equity to finance it. He is furthermore endowed with some private information about his firm's future earnings. The paper shows how, under certain conditions, the manager may credibly communicate his private information to investors through his accounting choices. In this equilibrium, the selection of balance sheet strengthening and income increasing accounting choices signals unfavourable information while the use of balance-sheet weakening and income-decreasing accounting choices signals favourable private information. The latter firms should thus experience positive abnormal returns around the announcement dates of their accounting choices.

1. Introduction

This paper presents a model seeking to explain discretionary accounting choices. It illustrates the 'information perspective' alluded to by Holthausen and Leftwich (1983), which asserts that the choice of an accounting technique reflects management's expectation of future earnings and cash flows. The treatment has similarities with Hughes and Schwartz (1988). It differs from Hughes and Schwartz in the following ways, however. First, the set of potential signals is not restricted to the choice of an inventory valuation method, which, in the US, affects corporate tax. Second, it is the adoption of conservative accounting policies that signals strength.

This paper is motivated by an investigation of 'depreciation switch-back'[1] firms carried out by Holthausen (1981). Holthausen hypothesises that managers change depreciation methods in order to relax binding[2] accounting-based constraints found in bond indentures, and that the common stock of a firm switching back from the accelerated to the straight-line depreciation method should therefore experience positive[3] abnormal returns at the time of the announcement of the change, the positive abnormal returns being an increasing function of the firm's leverage. Holthausen's empirical evidence seems inconsistent with his hypotheses. A first test provides evidence that the average abnormal return of the switch-back firms is weakly[4] negative around the announcement dates of the switches in depreciation methods. A second test provides evidence that the more debt a firm has outstanding, the more negative the abnormal performance at the time of the announcement of the change in depreciation methods. Holthausen (1981: 101), however, recognises that his empirical results may be consistent with an information perspective. He writes:

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[1] The use of accelerated depreciation for financial reporting purposes was allowed in the US by the 1954 taxation law. A large proportion of firms initially adopted the accelerated depreciation method. Depreciation switch-backs refer to a wave of changes in depreciation methods from accelerated to straight-line depreciation made during the 1960s.

[2] Debt contracts typically include accounting-based debt covenants, the most common ones requiring firms to maintain minimum net worth, limit leverage, and maintain adequate interest coverage (Press and Weintrop, 1990; Duke and Hunt, 1990). The switch from accelerated to straight-line depreciation is assumed in the accounting literature to reduce both the contemporaneous and the accumulated depreciation expenses, therefore relaxing the accounting-based constraints found in debt covenants.

[3] Binding covenants can be costly to the firm either because of the actions they prohibit or because of the costs incurred when repaying or renegotiating the debt issue to remove the covenant.

[4] The average abnormal return is not statistically significant at the 5% level. However, the test provides no control for surprises in current earnings.

> 'One hypothesis consistent with the observed results is that firms switch depreciation methods because the covenants of bond indenture agreements are expected to become binding. This change in turn, conveys information to the market concerning managers' expectations of future investment opportunities and earnings. If the leverage of the firm is proxying for the restrictiveness of the covenants, then the observed negative coefficient on leverage could be due to the market's expectation that firms with more restrictive leverage and dividend constraints will have greater costs imposed on them because of the poor future earnings.'

This paper introduces a model that is consistent with Holthausen's interpretation of the empirical evidence.[5] The model considers a firm whose capital structure consists of both debt and equity, a manager who protects the interests of the firm's existing shareholders, and a financial market. The manager is committed to engage in an investment opportunity and needs to raise some equity to finance it. He is furthermore endowed with some private information, favourable or unfavourable, about his firm's future earnings. This paper illustrates how, under certain conditions, the manager may credibly communicate his private information to investors through accounting choices such as the choice of a depreciation method for his firm's fixed assets.

In the equilibrium in which managers truthfully signal their private information, the manager endowed with favourable information chooses the accelerated depreciation method, and the manager endowed with unfavourable information chooses the straight-line depreciation method. Managers endowed with favourable information thus forgo the opportunity of reducing expected costs of breaching debt covenants. The benefit of not selecting the straight-line depreciation method consists of a higher market valuation, due to investors' belief that such behaviour signals favourable information and hence a lower fraction of the firm's equity that needs to be sold to raise the required amount of financing. Conversely, the manager endowed with unfavourable information chooses the straight-line depreciation method because the cost of being recognised as a manager endowed with unfavourable information does not exceed the benefit of reduced expected costs of breaching debt covenants.

The model may be extended to deal with a variety of discretionary accounting choices. In the extended model, the use of income-increasing and balance-sheet strengthening accounting choices signals unfavourable private information, while the use of income-reducing and balance-sheet weakening accounting choices signals favourable private information.

The revelation of private information through 'conservative' accounting choices relies on the costs incurred by firms when breaching their accounting-based debt covenants. Beneish and Press (1993) and Chen and Wei (1993) suggest that these costs are significant. Leftwich (1981) reports evidence that changes in generally accepted accounting principles do affect the firms' equity values by altering the accounting numbers defined in the restrictive covenants in their lending agreements. Empirical evidence reported by Bowen, Noreen and Lacey (1981), Daley and Vigeland (1983), Zmijewski and Hagerman (1981), and many more recent studies, suggest that constraints on key accounting variables written into debt arrangements may partially explain management's choice among other accounting alternatives. The empirical evidence reported by Duke and Hunt (1990) and Press and Weintrop (1990) furthermore suggests that leverage is indeed related to the existence of, and closeness to, accounting-based debt covenants.

This paper is organised as follows. The basic model introduced in the paper is analysed in Section 2. A variant of the basic model is analysed in Section 3. An extension to a continuum of types of firms can be found in Section 4. Section 5 closes with a summary.

2. The basic model

This section introduces a model that focuses on the manager's choice of a depreciation method[6] for his firm's stock of fixed assets in a world of asymmetric information. The model considers a firm whose capital structure consists of both debt and equity, a manager who protects the interests of the firm's existing shareholders, and a group of homogeneous potential investors referred to as the financial market. The manager is committed to engage in an investment opportunity and needs to raise some equity to finance it. He is furthermore endowed with some private information about his firm's future earnings. Both the manager and the financial market are assumed to be risk-neutral.[7] The firm's capital structure, investment decisions, and the resulting distribution of cash flows, are

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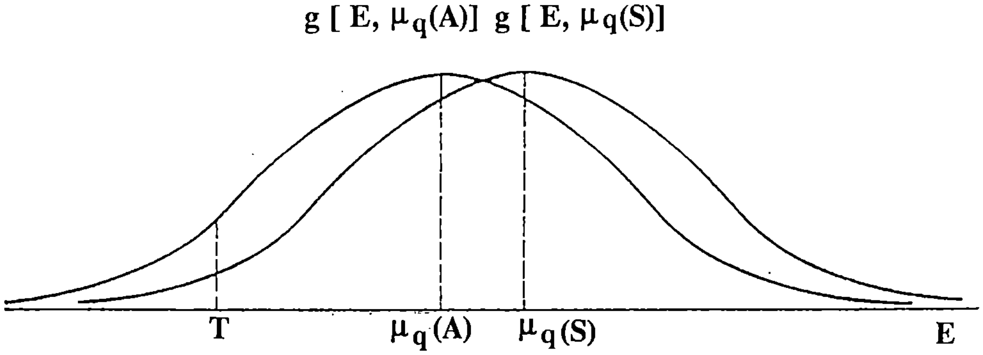
[5] It is also consistent with casual empiricism and journalistic accounts. Kieso and Weygandt (1992: 553), reporting evidence from a number of early empirical studies, assert that switches to more liberal accounting policies may 'signal that the company is in trouble' and 'lead to scepticism about management's attitudes and behaviour'.

[6] For illustration purposes only, managerial discretion in reporting is limited to the choice of a depreciation method.

[7] The introduction of risk-aversion generates risk-sharing considerations that are not important in this model.

Figure 1
Effect of a switch from the accelerated to the straight-line depreciation method on a firm's distribution of earnings



E = earnings obtaining at the end of the period;
T = earnings' threshold below which debt covenants are broken;
$g[E, \mu_q(A)]$ = the density function of earnings generated under the accelerated depreciation method by a firm of type q;
$g[E, \mu_q(S)]$ = the density function of earnings generated under the straight-line depreciation method by a firm of type q.

determined exogenously. The model is simplified in order to concentrate on the informative role of the depreciation method selected by the manager.

2.1. Description

There is an asymmetry of information between the manager and the financial market about the firm's earnings obtaining at the end of the period. The financial market is unsure whether the firm is a 'good' or a 'bad' firm, the two types of firms differing only in the distributions of earnings (and hence cash flows) obtaining at the end of the period. The cumulative distribution function of the good firm's earnings (using the accelerated depreciation method) is assumed to stochastically dominate in the first-order sense the cumulative distribution function of the bad firm's earnings (using the accelerated depreciation method). Firms with the higher expected earnings $\mu_G(A)$ are referred to as good firms and firms with the lower expected earnings $\mu_B(A)$ are referred to as bad firms. The manager has perfect knowledge of his firm's type. Investors' prior beliefs are that the firm is good with probability p.

2.1.1. Depreciation and Debt Covenants. The firm's capital structure consists of both debt and equity. Debtholders are protected by accounting-based debt covenants, which may consist of a minimum interest cover ratio, a minimum net worth, or a maximum leverage ratio. The specific form taken by these covenants is not critical to the model. The firm is assumed to breach its debt covenants[8] if the earnings reported at the end of the period fall below a certain threshold T. A breach of the debt covenants imposes exogenously defined costs C on the firm.

Under weak conditions that are assumed to exist (and taken for granted by the positive accounting literature), the depreciation expense under the accelerated depreciation method exceeds the depreciation expense under the straight-line depreciation method. As shown in Figure 1, a move from the accelerated to the straight-line depreciation method thus shifts a firm's distribution of earnings towards higher earnings. Selecting the straight-line depreciation method as opposed to the accelerated depreciation method thus decreases the probability that a firm, whatever its type, will breach its debt covenants and hence the ex-ante costs associated with breaching its debt covenants. As illustrated in Figure 2, the benefit associated with the use of the straight-line depreciation method is, however, higher to the bad firm than it is to the good firm, since the cumulative distribution function of the earnings generated by the good firm stochastically dominates in the first-order sense the cumulative distribution function of the earnings generated by the bad firm.

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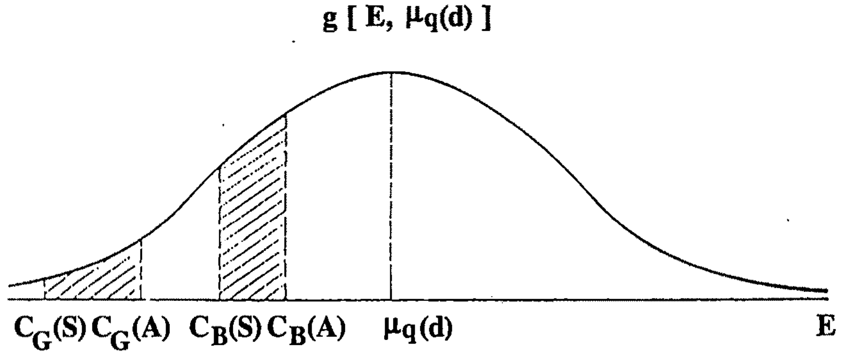
[8] The probability with which the bad firm breaks its debt covenants is assumed not to exceed one half.

Figure 2
Effect of a switch from the accelerated to the straight-line depreciation method on expected costs associated with breaks of covenants



g [E, μq(d)] = the density function of earnings E generated under the depreciation method d by a firm of type q, where {d=A} and {d=S} respectively represent the accelerated and the straight-line depreciation method, and {q=G} and {q=B} the good and the bad firm;

C_q (d) = the ex-ante costs associated with breaks of covenants of a firm of type q under the depreciation method d.

The model thus captures the fact that debt covenants are typically specified in terms of income or balance sheet numbers and, except for consistency with generally accepted accounting principles (GAAP), do not specify how these numbers are to be derived (Smith, 1993). Although debtholders are not explicitly modelled in this paper, rational debtholders anticipating the actions taken by the manager set ex-ante the issue price of the debt at a fair price reflecting the manager's actions, and are thus indifferent to the exact form taken by the debt covenants. Shareholders may, however, benefit from the lack of specification of accounting procedures.[9]

2.1.2. Manager's maximisation programme. At the current date, the firm's manager needs to raise £*K* by selling a stake α in his firm. The firm's manager, who protects the interests of his firm's existing[10] shareholders, must decide whether to use the accelerated or the straight-line depreciation method, knowing that the financial market rationally infers the type of his firm from his choice of accounting method. If α (*d*) represents the fraction of the firm's equity that must be sold to raise £*K* conditional on the use of the depreciation method *d*, where $\{d=A\}$ denotes the use of the accelerated depreciation method and $\{d = S\}$ denotes the use of the straight-line depreciation method, then $\alpha(d) = \dfrac{K}{E^M\,[V(d)]}$, where $E^M\,[V(d)]$ represents the market's conditional valuation of the firm's equity. The manager of a firm of type *q*, where $\{q=G\}$ denotes the good firm and $\{q=B\}$ denotes the bad firm, thus selects the depreciation method with the following objective:

$$\max_{d\in\{S,A\}} \left[1-\frac{K}{E^M[V\,(d)]}\right][V_q - C_q(d)] \qquad (1)$$

where V_q represents the intrinsic equity value of a firm of type *q* if the accounting-based debt covenants could not be breached and $C_q(d)$ represents the expected debt covenants' breach costs for a firm of type *q* choosing depreciation method *d*. Furthermore, given rational expectations by investors, the following equality must hold: $E^M[V(d)] = E[V_q - C_q(d)|d]$.

In order to get non-trivial results, the intrinsic value of the good firm's equity when the manager selects the accelerated depreciation method, $V_G - C_G(A)$, is assumed to be higher than the intrinsic value of the bad firm's equity when the manager selects the straight-line depreciation method, $V_B - C_B(S)$.

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[9] Shareholders are strictly better off if managerial discretion leads to a reduction in agency costs or if the cost of specifying the sets of accounting procedures in all possible states of nature is high enough.

[10] As in Ross (1977), Miller and Rock (1985), and Hughes and Schwartz (1988), the manager's objective function is assumed to depend on both the value of the firm's equity as inferred by the financial market, and the intrinsic value of the firm's equity as known by the manager. As in Darrough and Stoughton (1990), and in contrast to the former papers, the manager's objective function has the advantage of being endogenously derived from the need to raise external financing.

2.2. *Strategic Analysis*

The equilibrium concept used in this paper is a perfect Bayesian equilibrium. In the context of this paper[11], a perfect Bayesian equilibrium is a set of strategies and beliefs, made up by the good firm's choice of depreciation method, the bad firm's choice of depreciation method, the financial market's conditional valuation of the firm's equity, and the belief about the firm's type held by the financial market when faced with out-of-equilibrium selections of depreciation methods, satisfying the following properties: the choices of depreciation methods are optimal given the financial market's conditional valuation, and the financial market's belief about the firm's type is derived from the application of Bayes' rule whenever possible.

2.2.1. Separating equilibria. Necessary and sufficient conditions for the existence of separating equilibria, that is, equilibria in which the managers of the good and bad firms select different depreciation methods and hence reveal their firms' types, are captured by the following propositions:

Proposition 1. *A separating equilibrium, in which the manager of the good firm chooses the accelerated depreciation method and the manager of the bad firm chooses the straight-line depreciation method, does obtain if and only if:*

$$\frac{V_B - C_B(A)}{V_B - C_B(S)} \le \frac{1 - \frac{K}{V_B - C_B(S)}}{1 - \frac{K}{V_G - C_G(A)}} \le \frac{V_G - C_G(A)}{V_G - C_G(S)} \qquad (2)$$

Proof. A proof of Proposition 1 can be found in the Appendix.

The intuition is as follows. A separating equilibrium, in which the manager of the good firm adopts the accelerated depreciation method and the manager of the bad firm adopts the straight-line depreciation method, obtains if and only if it is incentive-compatible for both managers to act accordingly. The inequality on the right states that, for the manager of the good firm not to deviate from his equilibrium policy, the marginal gain from deviating, that is, the decrease in the expected costs of breaching debt covenants resulting from adopting the straight-line depreciation method, should be smaller than the marginal cost from deviating, that is, the decrease in the manager's objective function resulting from his firm being identified as a bad firm.

Similarly, the inequality on the left states that, for the manager of the bad firm not to deviate from his equilibrium policy, the marginal gain from deviating, that is, the increase in the manager's objective function resulting from his firm being identified as a good firm, should be smaller than the marginal cost from deviating, that is, the increase in the expected costs of breaking debt covenants resulting from adopting the accelerated depreciation method. These two conditions can be satisfied simultaneously because the marginal cost of adopting the accelerated depreciation method is higher to the manager of the bad firm than it is to the manager of the good firm.

Proposition 2. *No separating equilibrium, in which the managers of the bad and good firms respectively choose the accelerated and the straight-line depreciation methods, can possibly obtain.*

Proof. No separating equilibrium, in which the managers of the good and bad firms respectively choose the straight-line and accelerated depreciation methods, can obtain, because the manager of the bad firm would find it incentive-compatible to defect from his equilibrium strategy and pool with the manager of the good firm. By defecting from his equilibrium strategy, the manager of the bad firm enjoys the benefits resulting from both lower expected costs associated with breaches of debt covenants and a higher market valuation for his firms' equity.[12]

2.2.2. Pooling equilibria. Pooling equilibria, that is, equilibria in which the managers of the good and the bad firms select the same depreciation method and hence do not reveal their firms' types, may also obtain. Sufficient conditions for the existence of pooling equilibria are captured by the following propositions:

Proposition 3. *A pooling equilibrium, in which both the managers of the good and the bad firms choose the accelerated depreciation method and investors believe*[13] *that a firm deviating from its equilibrium strategy is a bad firm, does obtain if the prior probability p that the firm is good is high enough.*

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[11] Fudenberg and Tirole (1991: 326) define a perfect Bayesian equilibrium as 'a set of strategies and beliefs such that, at any stage of the game, strategies are optimal given the beliefs, and the beliefs are obtained from equilibrium strategies and observed actions using Bayes' rule'.

[12] By defecting from his equilibrium strategy, the manager of the bad firm derives the following utility: $(1 - \frac{K}{V_G - C_G(S)})$ $(V_B - C_B(S)) - (1 - \frac{K}{V_B - C_B(A)})\,(V_B - C_B(A))$, which is strictly positive.

[13] A pooling equilibrium, in which the managers of both types of firms choose the accelerated depreciation method, may also obtain with more optimistic beliefs.

Proof. A formal proof of Proposition 3 can be found in the Appendix.

The intuition is as follows. The choice of the accelerated depreciation method is more costly to the manager of the bad firm than it is to the manager of the good firm. It would thus appear to be reasonable for any firm deviating from the pooling equilibrium strategy, in which the managers of both the good and bad firms adopt the accelerated depreciation method, to be perceived to be a bad firm by the financial market. This pooling equilibrium can only obtain if investors' prior beliefs are that the firm is a good firm with a high enough probability, since otherwise, the marginal benefit accruing to the manager of a bad firm deviating from the pooling equilibrium strategy, that is, the decrease in the expected costs associated with breaches of debt covenants resulting from adopting the straight-line depreciation method, would exceed the marginal cost associated with it, that is, the decrease in the manager's objective function resulting from his firm being valued as a bad firm by the financial market.

Proposition 4. *A pooling equilibrium, in which both the managers of the good and the bad firms choose the straight-line depreciation method and investors believe*[14] *that a firm deviating from its equilibrium strategy is a good firm, does obtain if the prior probability* p *that the firm is good is high enough.*

Proof. A proof of Proposition 4 can be found in the Appendix. The intuition is similar to that of Proposition 3.

2.2.3. Market reactions to depreciation switchbacks.

Proposition 5. *If, prior to the current date, the managers of both the good and the bad firms used the accelerated depreciation method, the financial market expected that a separating equilibrium would obtain, and a separating equilibrium obtains, the market reaction to firms staying with the accelerated depreciation method will be positive*[15]*, while the market reaction to firms selecting the straight-line depreciation method will be negative.*

Proof. A formal proof of Proposition 5 can be found in the Appendix. The intuition is as follows. The market reactions to the announcements of the depreciation methods selected by managers reflect the fact that a firm's choice of depreciation method reveals the firm's type.

The following corollary introduces a comparative statics result which constitutes a 'core result' of Holthausen (1981). In accordance with Kalay (1979) and Holthausen (1981), it will be assumed that the size of the exogenously imposed costs C on a firm breaking its debt covenants is a strictly increasing function of the level of debt with which the firm is endowed.

Corollary 1. *If, prior to the current date, the managers of both the good and the bad firms used the accelerated depreciation method, the financial market expected that a separating equilibrium will obtain, and a separating equilibrium obtains, the abnormal share price reaction to the announcement of a change in depreciation method will be negatively related to leverage as long as the probability of bankruptcy is small enough.*

Proof. By differentiating the market reaction with respect to the firm's level of debt, one obtains $\frac{d[C_G(A)-C_B(S)]}{dD}-\frac{d(V_G-V_B)}{dD}$, which is negative as long as the size of the costs C imposed on firms breaking their debt covenants is a strictly increasing function of the level of debt, and the probability of bankruptcy is small enough.

3. A variant of the basic model

In the previous section, the firm's manager had to select a depreciation method to depreciate his firm's fixed assets. Many types of equilibria could possibly obtain. A number of these equilibria may, however, have been sustained by 'unreasonable' beliefs off the equilibrium path. Strategic refinements are typically used in order to put 'sensible restrictions' on beliefs off the equilibrium path. The specific form taken by the model introduced in the previous section, which was motivated by Holthausen (1981), however, does not allow for the effective use of commonly used strategic refinements. In this section, we introduce a variant of the basic model introduced in the previous section, allowing for the effective use of strategic refinements.

In this section, the manager must select a depreciation rate to depreciate his firm's fixed assets, with the depreciation rate v having to be chosen from the interval $[v_{Min}, v_{Max}]$. The probability of seeing a firm of type q breach its debt covenants and hence the expected costs associated with these breaches, $C_q(v)$, are assumed to be strictly increasing functions of the depreciation rate v. The intrinsic value of the good firm's equity when the manager selects the highest possible depreciation rate v_{Max}, $V_G - C_G(v_{Max})$, is assumed to be higher than the intrinsic value of the bad firm's equity when the manager selects the lowest possible depreciation rate v_{Min}, $V_B - C_B(v_{Min})$. The other assumptions made in the previous section do still apply here. These assumptions enable us to derive the following proposition:

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[14] A pooling equilibrium in which the managers of both types of firms choose the straight-line depreciation method may, however, also obtain without any restrictions on the prior probability p if investors believe that a firm deviating from its equilibrium strategy is a bad firm.

[15] The market reaction to the announcement that a firm stays with the accelerated depreciation method is positive even if investors did not expect the separating equilibrium to obtain, because the manager of the good firm would have no incentive to select the accelerated depreciation method otherwise. The positive market reaction more than compensates for the higher expected costs of breaking debt covenants associated with the adoption of the accelerated depreciation method.

Proposition 6. *A continuum of both pooling and separating equilibria can potentially obtain. In the separating equilibria, the manager of the bad firm chooses to depreciate the fixed assets of his firm at the lowest depreciation rate v_{Min}, while the manager of the good firm chooses to depreciate the fixed assets of his firm at a strictly higher depreciation rate. Both pooling and separating equilibria are sequential. But the efficient separating equilibrium*[16] *and the pooling equilibrium, in which the managers of both the good and bad firms choose to depreciate their fixed assets at the highest depreciation rate v_{Max}, are the only equilibria to survive Cho and Kreps' (1987) D1 criterion, Banks and Sobel's (1987) ultimate divinity, and Kohlberg and Mertens' (1986) NWBR strategic refinements.*[17] *Furthermore, it can be shown that both equilibria cannot coexist for a given set of parameters and that the efficient separating equilibrium is the only equilibrium to survive these strategic refinements as long as the amount of financing raised* K *is small enough.*

Proof. The proof of the first part of Proposition 6 related to the existence of various types of equilibria is similar to the proofs of some of the previous propositions and is therefore omitted. The proof of the proposition related to strategic refinements can be found in the Appendix.

4. Extension to a continuum of types of firms

The model introduced in the previous section is extended to deal with a continuum of types of firms. The type of the firm is captured by q, with q being distributed on the interval $[q_{Min}, q_{Max}]$ according to a strictly increasing distribution function. Firms of types $\underline{q}$ and $\tilde{q}$, with $\underline{q} < \tilde{q}$, differ only in the earnings (and hence cash flows) generated at the end of the period. The cumulative distribution of the earnings generated at the end of the period by a firm of type $\tilde{q}$ stochastically dominates in the first-order sense the cumulative distribution of the earnings generated at the end of the period by a firm of type $\underline{q}$. The manager has perfect knowledge of his firm's type. The financial market only knows the distribution of q.

As in the previous section, the manager must select a depreciation rate to depreciate his firm's fixed assets, with the depreciation rate v having to be chosen from the interval $[v_{Min}, v_{Max}]$. The probability of seeing a firm of type q using depreciation rate v breach its debt covenants, and hence the expected costs associated with these breaches, $C_q(v)$, are assumed to be strictly increasing functions[18] of the depreciation rate v. If, as is assumed in the previous sections, the probability with which a firm of any type breaches its debt covenants does not exceed one half, the increase in the expected costs associated with breaches of debt covenants induced by a marginal increase in the selected depreciation rate is decreasing in the firm's type. The intrinsic value of a firm's equity is furthermore assumed to be increasing in q.

As in the previous sections, the firm's manager, protecting the interests of the existing shareholders, needs to raise £K through an issue of equity. He selects a depreciation rate v, aware that the financial market perceives the firm's type q to be a function of the depreciation rate. This function[18] will be referred to as $q(v)$. The manager of a firm of type q thus selects the depreciation rate v maximising $\left[1-\dfrac{K}{V_{q(v)}-C_{q(v)}(v)}\right][V_q - C_q(v)]$. Maximising this objective function for any given market valuation schedule, $q(v)$ determines an optimal depreciation rate v^*, which depends on the type of the firm q. We are, however, not interested in any arbitrary market valuation schedule $q(v)$. Rather, we shall restrict our attention to market valuation schedules that have an equilibrium property. A market valuation schedule[19] $q(v)$ is said to be an equilibrium valuation schedule if the quality of the firm q is correctly identified by the market for all values of q. More formally: $q[v^*(q)] = q$. The extended model introduced in this section enables us to derive the following proposition:

Proposition 7. *There exists a unique efficient equilibrium valuation schedule* q(v). *This equilibrium valuation schedule is a strictly increasing function of the depreciation rate v. It is furthermore implementable, that is, the depreciation rate selected by the best firm does not exceed v_{Max}, as long as the required amount of financing* K *is small enough.*

Corollary 2. *The market reaction to the announcement of a choice of depreciation rate should be increasing in the depreciation rate.*

Proof. A formal proof of Proposition 7 and its corollary can be found in the Appendix. More intuitively, this proposition obtains because the increase in the expected costs associated with breaches of debt covenants induced by a marginal increase in the selected depreciation rate is decreasing in the firm's quality.

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[16] In the efficient separating equilibrium, the manager of the good firm elects to depreciate his firm's fixed assets at the depreciation rate v^*, which leaves the manager of the bad firm indifferent between complying with and defecting from his equilibrium choice of depreciation rate.

[17] An introduction to these strategic refinements can be found in Fudenberg and Tirole (1991).

[18] These functions are assumed to be infinitely differentiable in all variables. The proposition derived in this section would, however, still hold if they were differentiable almost anywhere.

[19] This definition of an equilibrium valuation schedule is similar to the one provided by Leland and Pyle (1977).

5. Summary

This paper provides a debt covenants-based explanation for the discretionary accounting choices such as the choices of accounting procedures made by managers in a world in which managers are endowed with private information about their firms' future earnings. It considers a firm whose capital structure consists of both equity and debt, a manager who protects the interests of the firm's existing shareholders, and a financial market. The manager is committed to engage in an investment opportunity and needs to raise some equity to finance it. He is furthermore endowed with some private information about his firm's future earnings. The paper illustrates through the selection of a depreciation method how managers may credibly communicate their private information through discretionary accounting choices.

In the equilibrium in which managers truthfully signal their private information, the manager endowed with favourable information chooses the accelerated depreciation method and the manager endowed with unfavourable information chooses the straight-line depreciation method. Managers endowed with favourable information thus forgo the opportunity of reducing expected costs of breaching debt covenants. The benefit of not selecting the straight-line depreciation method consists of a higher market valuation, due to investors' belief that such behaviour signals favourable information and hence a lower fraction of the firm's equity that needs to be sold to raise the required amount of financing. Conversely, the manager endowed with unfavourable information chooses the straight-line depreciation method because the cost of being recognised as a manager endowed with unfavourable information does not exceed the benefit of reduced expected costs of breaching debt covenants.

The paper predicts that, when a separating equilibrium prevails, the firms choosing the accelerated depreciation method are likely to see higher earnings in the next periods than the firms choosing the straight-line depreciation method. It also predicts that the former firms should experience, on average, positive abnormal returns around announcement dates. The empirical predictions generated by this paper are furthermore broadly consistent with the empirical evidence reported by Holthausen (1981).

The model may be extended to deal with a variety of discretionary accounting choices, such as the selection of the amortisation period for unfunded pension liabilities (US), the decision whether or not to revalue fixed assets (UK), and choices of accounting procedures to account for interest, investment tax credits (US), and development expenditure (UK). In the extended model, the use of income-increasing and balance-sheet strengthening accounting choices signals unfavourable private information, while the use of income-reducing and balance-sheet weakening accounting choices signals favourable private information. In the context of the UK, where revaluations of non-depreciated fixed assets are quite common, the model may be tested through an empirical investigation of the information content of revaluations, which are hypothesised to convey bad news.

Appendix

A.1. Proof of Proposition 1

Let us consider the following set of strategies: the manager of the good firm chooses to adopt the accelerated depreciation method, while the manager of the bad firm chooses to adopt the straight-line depreciation method. By deviating from his separating strategy and pooling with the manager of the bad firm, the manager of the good firm derives the following incremental utility:

$$\left(1-\frac{K}{V_B-C_B(S)}\right)(V_G-C_G(S))-\left(1-\frac{K}{V_G-C_G(A)}\right)(V_G-C_G(A)) \qquad (3)$$

Similarly, by deviating from his separating strategy and pooling with the manager of the good firm, the manager of the bad firm derives the following incremental utility:

$$\left(1-\frac{K}{V_G-C_G(A)}\right)(V_B-C_B(A))-\left(1-\frac{K}{V_B-C_B(S)}\right)(V_B-C_B(S)) \qquad (4)$$

Neither the manager of the good firm nor the manager of the bad firm thus have any incentive to deviate if and only if the following set of inequalities is satisfied:

$$\frac{V_B-C_B(A)}{V_B-C_B(S)} \leq \frac{1-\frac{K}{V_B-C_B(S)}}{1-\frac{K}{V_G-C_G(A)}} \leq \frac{V_G-C_G(A)}{V_G-C_G(S)} \qquad (5)$$

Proposition 1 thus obtains.

A.2. Proof of Proposition 3

Let us consider the following set of strategies and beliefs. Both the manager of the good firm and the manager of the bad firm choose to adopt the accelerated depreciation method. Investors believe that any firm whose manager deviates from this equilibrium strategy is a bad firm. By deviating from his pooling strategy, the manager of the good firm derives the following incremental utility:

$$\left(1-\frac{K}{V_B-C_B(S)}\right)(V_G-C_G(S))-\left(1-\frac{K}{V_{PA}}\right)(V_G-C_G(A)) \qquad (6)$$

where $V_{PA}\equiv p\,(V_G-C_G(A))+(1-p)\,(V_B-C_B(A))$. Similarly, by deviating from his pooling strategy, the manager of the bad firm derives the following incremental utility:

$$\left(1-\frac{K}{V_B-C_B(S)}\right)(V_B-C_B(S))-\left(1-\frac{K}{V_{PA}}\right)(V_B-C_B(A)) \qquad (7)$$

Neither the manager of the good firm nor the manager of the bad firm thus have any incentive to deviate if and only if the following inequality is satisfied:

$$p\geq Max(p_1,p_2) \qquad (8)$$

where:

$$p_1=\frac{\dfrac{K}{1-(1-\frac{K}{V_B-C_B(S)})\frac{V_G-C_G(S)}{V_G-C_G(A)}}-(V_B-C_B(A))}{(V_G-C_G(A))-(V_B-C_B(A))} \qquad (9)$$

and:

$$p_2=\frac{\dfrac{K}{1-(1-\frac{K}{V_B-C_B(S)})\frac{V_B-C_B(S)}{V_B-C_B(A)}}-(V_B-C_B(A))}{(V_G-C_G(A))-(V_B-C_B(A))} \qquad (10)$$

Proposition 3 thus obtains.

A.3. Proof of Proposition 4

Let us consider the following set of strategies and beliefs. Both the manager of the good firm and the manager of the bad firm choose to adopt the straight-line depreciation method. Investors believe that any firm whose manager deviates from this equilibrium strategy is a good firm. By deviating from his pooling strategy, the manager of the good firm derives the following incremental utility:

$$\left(1-\frac{K}{V_G-C_G(A)}\right)(V_G-C_G(A))-\left(1-\frac{K}{V_{PS}}\right)(V_G-C_G(S)) \qquad (11)$$

where $V_{PS}\equiv p(V_G-C_G(S))+(1-p)\,(V_B-C_B(S))$. Similarly, by deviating from his pooling strategy, the manager of the bad firm derives the following incremental utility:

$$\left(1-\frac{K}{V_G-C_G(A)}\right)(V_B-C_B(A))-\left(1-\frac{K}{V_{PS}}\right)(V_B-C_B(S)) \qquad (12)$$

Neither the manager of the good firm nor the manager of the bad firm thus have any incentive to deviate if and only if the following inequality is satisfied:

$$p\geq Max(p_3,p_4) \qquad (13)$$

where:

$$p_3=\frac{\dfrac{K}{1-(1-\frac{K}{V_G-C_G(A)})\frac{V_G-C_G(A)}{V_G-C_G(S)}}-(V_B-C_B(S))}{(V_G-C_G(S))-(V_B-C_B(S))} \qquad (14)$$

and:

$$p_4=\frac{\dfrac{K}{1-(1-\frac{K}{V_G-C_G(A)})\frac{V_B-C_B(A)}{V_B-C_B(S)}}-(V_B-C_B(S))}{(V_G-C_G(S))-(V_B-C_B(S))} \qquad (15)$$

Proposition 4 thus obtains.

A.4. Proof of Proposition 5

If, at the current date, the financial market expects that a separating equilibrium is to obtain, the market value of a firm of any type is $p[V_G-C_G(A)]+(1-p)[V_B-C_B(S)]$. When the separating equilibrium obtains, the market values of the good and bad firms are respectively $V_G-C_G(A)$ and $V_B-C_B(S)$. The market reaction to the news that a given firm stays with the accelerated depreciation method is thus $(1-p)$ $[[V_G-C_G(A)]-[V_B-C_B(S)]]$. The market reaction to the accelerated depreciation announcement is therefore positive. Similarly, the market reaction to the news that a given firm switches to the straight-line depreciation method is $-p[[V_G - C_G(A)] - [V_B - C_B(S)]]$. The market reaction to the straight-line depreciation announcement is therefore negative.

A.5 Proof of Proposition 6

A.5.1. Sequential equilibrium. Fudenberg and Tirole (1991: 346) have shown that any perfect Bayesian equilibrium constitutes a sequential equilibrium as long as there are fewer than two stages in the game.

A.5.2. D1 criterion. We first prove that no pooling equilibrium, in which the managers of both the good and bad firms choose to depreciate their fixed assets at v, where $v < v_{Max}$, survives the D1 strategic refinement designed by Cho and Kreps (1987). Let us therefore assume that such a pooling equilibrium does obtain and consider an out-of-equilibrium depreciation rate $\hat{v}$ in the neighbourhood of v, where $v < \hat{v} < v_{Max}$. We then define $\hat{V}_G$ so as to satisfy the following equality:

$$\left[1 - \frac{K}{\hat{V}_G}\right][V_G - C_G(\hat{v})] = \left[1 - \frac{K}{V_P(v)}\right][V_G - C_G(v)] \quad (16)$$

where:

$$V_p(v) \equiv p\,(V_G - C_G(v)) + (1-p)(V_B - C_B(v)) \quad (17)$$

Similarly, we define $\hat{V}_B$ so as to satisfy the following equality:

$$\left[1 - \frac{K}{\hat{V}_B}\right][V_B - C_B(\hat{v})] = \left[1 - \frac{K}{V_P(v)}\right][V_B - C_B(v)] \quad (18)$$

By combining equalities 16 and 18, one obtains the following equality:

$$\frac{1 - \frac{K}{\hat{V}_G}}{1 - \frac{K}{\hat{V}_B}} = \frac{V_G - C_G(v)\; V_B - C_B(\hat{v})}{V_G - C_G(\hat{v})\; V_B - C_B(v)} \quad (19)$$

From the previous equality, it is clear that $\hat{V}_G < \hat{V}_B$. The sets of best market responses Ω_B and Ω_G, inducing the managers of the bad and good firms to defect from their equilibrium actions, are therefore $\Omega_G = (\hat{V}_G, V_G - C_G(\hat{v})]$ and $\Omega_B = (\hat{V}_B, V_G - C_G(\hat{v})]$ and it is clear that $\Omega_B \subset \Omega_G$. When faced with the out-of-equilibrium depreciation rate $\hat{v}$, investors should therefore believe that the firm is good. But these beliefs induce the manager of the good firm to defect from his equilibrium strategy to some $\hat{v}$ in the neighbourhood of v. No pooling equilibrium, in which the managers of both the good and bad firms choose to depreciate their fixed assets at v, where $v < v_{Max}$, can therefore survive the D1 strategic refinement designed by Cho and Kreps (1987).

We now prove that no non-efficient separating equilibrium can survive Cho and Kreps' D1 strategic refinement. Let us therefore consider a separating equilibrium in which the depreciation rate v chosen by the manager of the good firm is larger than v^*. Whatever the response of the financial market, the manager of the bad firm would never want to choose an out-of-equilibrium depreciation rate $\hat{v}$, where $v^* < \hat{v} < v$. This is so because v^* is the value taken by the depreciation rate for which the manager of the bad firm is indifferent between playing his equilibrium strategy and being identified as the manager of a bad firm, and choosing v^*, and being identified as the manager of a good firm. The manager of the good firm, however, may find it incentive-compatible to report $\hat{v}$. Let us define $\hat{V}_G$ to satisfy the following equation:

$$\left[1 - \frac{K}{\hat{V}_G}\right][V_G - C_G(\hat{v})] = \left[1 - \frac{K}{V_G - C_G(v)}\right][V_G - C_G(v)] \quad (20)$$

The sets of best responses by the market Ω_B and Ω_G, inducing the managers of the bad and good firms to defect from their equilibrium actions, are therefore $\Omega_B = \emptyset$ and $\Omega_G = (\hat{V}_G, V_G - C_G(\hat{v})]$ and it is clear that $\Omega_B \subset \Omega_G$. When faced with the out-of-equilibrium write-off $\hat{v}$, investors should therefore believe that the firm is good. But these beliefs induce the manager of the good firm to defect from his equilibrium strategy. No non-efficient separating equilibrium can therefore survive Cho and Kreps' D1 strategic refinement.

We now prove that the efficient separating equilibrium survives Cho and Kreps' D1 strategic refinement. To do this, we have to consider two potential types of defections $\hat{v}$:

(i) $0 < \hat{v} < v^*$

(ii) $v^* < \hat{v}$

(i) Let us first consider a defection $\hat{v}$, where $0 < \hat{v} < v^*$. We already know that, in equilibrium, the manager of the bad firm is indifferent between his equilibrium action and that of the manager of the good firm. More formally:

$$\left[1-\frac{K}{V_G-C_G(v^*)}\right][V_B-C_B(v^*)]=\left[1-\frac{K}{V_B-C_B(v_{Min})}\right][V_B-C_B(v_{Min})] \qquad (21)$$

Let us define $\hat{V}_G$ so as to satisfy the following equality:

$$\left[1-\frac{K}{\hat{V}_G}\right][V_G-C_G(\hat{v})]=\left[1-\frac{K}{V_G-C_G(v^*)}\right][V_G-C_G(v^*)] \qquad (22)$$

Similarly, let us define $\hat{V}_B$ so as to satisfy the following equality:

$$\left[1-\frac{K}{\hat{V}_B}\right][V_B-C_B(\hat{v})]=\left[1-\frac{K}{V_B-C_B(v_{Min})}\right][V_B-C_B(v_{Min})] \qquad (23)$$

By replacing equalities 22 and 23 into 21, we obtain the following equality:

$$\frac{1-\frac{K}{\hat{V}_G}}{1-\frac{K}{\hat{V}_B}}=\frac{V_B-C_B(\hat{v})}{V_B-C_B(v^*)}\,\frac{V_G-C_G(v^*)}{V_G-C_G(\hat{v})} \qquad (24)$$

From the previous equality, it is clear that $\hat{V}_G > \hat{V}_B$ since $v^* > \hat{v}$. The sets of best market responses Ω_B and Ω_G, inducing the managers of the bad and good firms to defect from their equilibrium actions, are therefore $\Omega_G = (\hat{V}_G, V_G - C_G(\hat{v})]$, and it is clear that $\Omega_G \subset \Omega_B$. When faced with an out-of-equilibrium depreciation rate $\hat{v}$, investors should therefore believe that the firm is bad. But, given these beliefs, no manager wishes to defect from his equilibrium strategy.

(ii) Alternatively, let us consider a defection $\hat{v}$, where $v^* < \hat{v}$. Even if investors believe with probability one that the defector is a good firm, no firm will ever wish to defect.

It has been shown that no firm will ever wish to defect. The efficient equilibrium thus survives Cho and Kreps' D1 strategic refinement.

A.5.3. Ultimate divinity and NWBR. Cho and Sobel (1990) show that, for any monotonic signalling game, the universal divinity and NWBR criteria are equivalent to the D1 criterion.

A.6. Proof of Proposition 7

Riley (1979) provides a number of conditions guaranteeing both the existence and the uniqueness of an efficient equilibrium valuation schedule. The first subsection establishes that the model described in this paper meets the six conditions stated by Riley. The second subsection establishes conditions in which the equilibrium valuation schedule is implementable, that is, the equilibrium depreciation rate chosen by the manager of the highest quality firm does not exceed v_{Max}. The third subsection establishes that the abnormal share price reaction to the choice of depreciation rate is strictly increasing in the magnitude of the depreciation rate.

A.6.1. Riley conditions. Using Riley's notations, the manager's objective function may be rewritten as:

$$I(q, v, I^M)=(1-\frac{K}{I^M})I^D(q, v) \qquad (25)$$

Riley's conditions for the existence of a unique equilibrium valuation schedule can be expressed as follows:

1. The unobservable parameter q is distributed on a closed interval according to a strictly increasing distribution function;
2. The functions $I(.)$ and $I^D(.)$ are infinitely differentiable in all variables;
3. $\frac{\partial I}{\partial I^M}>0$;
4. $I^D(q, v)>0, \frac{\partial I^D(q, v)}{\partial q}>0$;
5. When $I_2 \equiv \frac{\partial I}{\partial v}$ and $I_3 \equiv \frac{\partial I}{\partial I^M}$, the partial derivative of $-\frac{I_2}{I_3}$ with respect to q is negative;
6. $I[q, v, I^D(q, v)]$ has a unique maximum over v.

The first four conditions are trivially satisfied. The fifth condition is satisfied because:

$$\frac{\partial}{\partial q}\left(-\frac{I_2}{I_3}\right)=\frac{\partial}{\partial q}\left[\frac{\left(1-\frac{K}{I^M}\right)\left(I^M\right)^2}{K\,I^D}\,\frac{\partial C_q}{\partial v}(v)\right]<0 \qquad (26)$$

The sixth condition is satisfied since $v = v_{Min}$ is the only maximum of $I[q, v, I^D(q, v)]$. As Riley's conditions are satisfied, there exists a unique efficient equilibrium valuation schedule $q(v)$.

A.6.2. Implementability of the equilibrium valuation schedule. From the First Order Condition, one can show that the valuation schedule $q(v)$ satisfies the following equality:

$$\left.\frac{dq(v)}{dv}\right|_{v=v^*(q)} = \frac{1}{K}\,\frac{\left.\dfrac{\partial C_q(v)}{\partial v}\right|_{v=v^*(q)}}{\left.\dfrac{dV_q}{dq}\right|_q - \left.\dfrac{\partial C_q(v)}{\partial q}\right|_{v=v^*(q)}} > 0 \quad (27)$$

The equilibrium valuation schedule is thus a strictly increasing function of the depreciation rate. It is also implementable as long as the amount of finance raised is small enough, since $\forall q$:

$$\lim_{K \to 0} \frac{dv^*(q)}{dq} = 0 \quad (28)$$

A.6.3. Abnormal returns. By rewriting the First Order Condition, one obtains the following equality:

$$\frac{K}{[I^M(q)]^2}\, I^D[q, v^*(q)] \left.\frac{dI^M(v)}{dv}\right|_{v=v^*(q)} = -\left[1 - \frac{K}{I^M(q)}\right] \left.\frac{dI^D(q, v)}{dv}\right|_{v=v^*(q)} \quad (29)$$

$$> 0$$

The abnormal share price reaction to the choice of depreciation rate is thus strictly increasing in the magnitude of the depreciation rate.

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Organisational Culture and Budgetary Control in a UK Local Government Organisation

Andrew Goddard*

Abstract—This paper is an attempt to explore the possibilities of working within the functional paradigm to understand the relationship between organisational culture and financial control. More specifically, the research is an empirical study informed by contingency theory. The research uses canonical correlation analysis to investigate the complex contingent relationship, as suggested by Williams, McIntosh and Moore (1990). The research was carried out within a local government organisation in the UK, and used a questionnaire to determine managers' perceptions of organisational culture and budget-related behaviour. A correlation was found between organisational culture and budget-related behaviour, particularly with respect to budgetary participation and the usefulness of budgets to support the managerial role. However, the relationship was not straightforward, and the analysis indicated some tension between culture and the financial control system in operation.

1. Background

The relationship between organisational culture and financial control systems (FCSs) is one of increasing interest (Dent, 1991; Bourn and Ezzamel, 1986; Ferguson and Lapsley, 1988; Birnberg and Snodgrass, 1988; Broadbent, 1992; Harrison, 1992, 1993). Many of these studies have looked at the interaction between culture and FCSs in public sector organisations. They have used a variety of definitions of culture, though all refer to values and/or beliefs as central to the concept. It seems reasonable to hypothesise that an organisation's core beliefs will be reflected in the budget-related behaviour associated with its financial control system. In testing this broad hypothesis, previous research has been informed by either the interpretive paradigm or the functional paradigm. This paper is informed by the functional paradigm, and draws upon previous research into organisational culture and budget-related behaviour within this paradigm.

1.1. Organisational Culture

There is a well-developed literature on the topic of organisational culture, with three major series of papers having been published in *Administrative Science Quarterly* in 1983, *Organisational Dynamics* in 1985 and the *Journal of Management Studies* in 1986. There are many definitions of organisational culture in both the functionalist and interpretive paradigms. The functional paradigm views culture as something that can be objectively determined and measured. Within the paradigm, organisational theory has been heavily influenced by systems and contingency theory, and organisational culture has been seen as a variable. Smircich (1983) categorises such approaches into those that treat culture as an internal variable, when culture is viewed as something which can be managed and therefore changed by corporate managers; and those that treat culture as an external variable which is imported to an organisation by its members and cannot be changed by corporate managers. The former approach can be further subdivided into corporate culture and organisational climate, as illustrated in Figure 1.

Corporate culture studies see culture as a system of shared values and beliefs, and seek to identify these, their causes and their management (Deal and Kennedy, 1982; Peters and Waterman, 1982). These studies tend to emphasise the role of leaders and senior corporate managers in the development of organisational culture. Organisational climate studies concentrate on causes such as managers' personal attributes, and measure culture using

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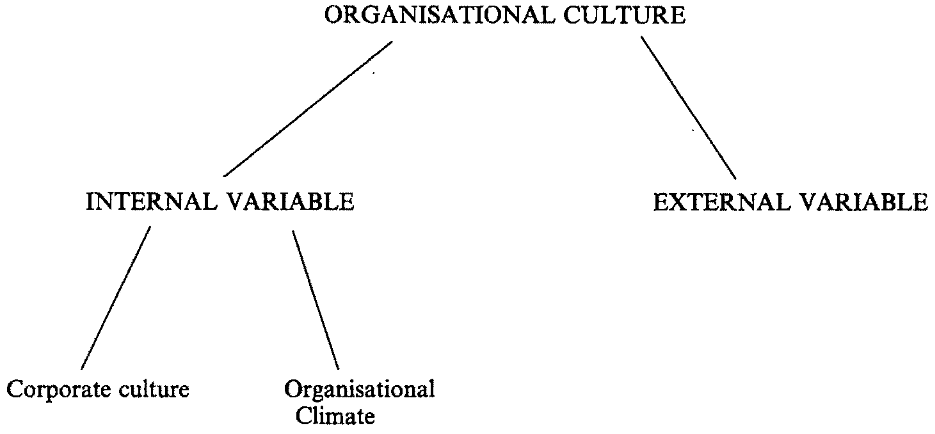
*The author is a senior lecturer at the University of Southampton. He wishes to thank participants at the British Accounting Association Annual Conference, Winchester 1994, the European Accounting Association Conference, Venice 1994, and the two anonymous referees for their comments on an earlier version of this paper. Correspondence should be addressed to Mr Goddard at the School of Management, Division of Accounting and Finance, University of Southampton, Highfield, Southampton SO17 1BJ. This paper was submitted in September 1994 and accepted in December 1996.

Figure 1
Functional approaches to organisational culture



managers' perceptions of climate (Litwin and Stringer, 1968).

Rather than consider these approaches as mutually exclusive, it seems reasonable to view them as emphasising different aspects of organisational culture. These cultural aspects taken together can be seen as constituting the overall organisational culture. Reynolds (1986) has developed a definition of organisational culture as an internal variable which draws upon both the corporate culture and organisational climate perspectives (see below).

Studies where culture is seen as an external variable tend to be cross-national studies, where national values are measured and related to organisational values (Ouchi, 1981; Pascale and Athos, 1981; Hofstede, 1980).

1.2. Budget-related Behaviour

Budget-related behaviour (BRB) refers to those managerial activities, actions, attitudes and interactions among managers and their tasks that occur on a regular basis and which are related to the system of budgetary controls (Williams et al., 1990) The BRB literature establishes many aspects worthy of study, including participation (Argyris, 1952; Becker and Green, 1962; Brownell, 1982; Brownell and McInnes, 1986) and budgeting style of evaluating performance (Hopwood, 1972, 1974; Otley, 1978; Hirst, 1981).

In this paper, BRB is examined using the behavioural factors identified by Bruns and Waterhouse (1975) and Williams et al. (1990). Bruns and Waterhouse (1975) found that BRB could be described using 13 factors, including participation, evaluation by budget, enabling features, limiting features, support, acceptance of methods, and required explanation of variances. Such behaviour was found to be contingent upon various aspects of organisational structure such as centralisation, autonomy and the degree to which activities were structured. They concluded that there must be alternative organisational control strategies in different kinds of organisation.

Williams et al. (1990) defined budget characteristics in a very similar way in a contingency study of BRB in public sector organisations. Their findings concerning the significant behavioural factors were very similar to those in the private sector study by Bruns and Waterhouse, suggesting that such behaviour is similar in both private and public sectors. To facilitate analysis, the factors were categorised as (1) measuring and monitoring, (2) participation, (3) formal communication and (4) enabling change. They extended the analysis offered by Bruns and Waterhouse and concluded that there was evidence of support for the contingency notion of fit between budgeting behaviour and departmental performance in the context of task interdependency. However, the correlations between contingent variables and BRB are small, even though significant. This suggests that other contingent variables influence BRB, and this research is concerned with investigating the possibility of organisational culture being one such variable.

1.3. Organisational Culture and BRB

Ouchi (1977, 1979) was one of the first writers to suggest that culture was an important factor in the design and operation of organisational control systems. He suggested that under the circumstances of congruence about objectives and difficulty in measuring performance, organisations would have to rely on 'clans' to ensure control. Such circumstances often prevail in the public sector, with important consequences for FCS design (Bourn and Ezzamel, 1987).

Empirical research in the functional paradigm, into culture and FCSs, has largely been concerned with national cultural characteristics and BRB (Birnberg and Snodgrass, 1988; Chow, Kato and Shields, 1994; Harrison, 1992, 1993; Ueno and Wu, 1993; Chow, Shields and Chan, 1991). There is no previous empirical research reported in the literature informed by a functionalist methodology into the relationship between organisational culture, as opposed to national culture, and BRB.

Flamholtz (1983) and Markus and Pfeffer (1983) both identified culture as an important contingent variable, but from a largely theoretical perspective. They both argued that financial control system design had to be consistent with organisational values or culture, otherwise the system would encounter resistance and eventually fail. A major contribution of the research reported in this paper is its empirical analysis of these theoretical relationships.

2. Research method

2.1. Research Model

The general model adopted in this research hypothesises that budget-related behaviour may have cultural roots. It is generally accepted that individuals behave in accordance with their beliefs or values. These beliefs or values may well, in turn, be influenced by the prevailing organisational culture. A contingency model of the relationship between these factors may be constructed as illustrated in Figure 2. This model incorporates previous contingency studies that established a relationship between other contingent variables such as structure and size, and BRB. It also acknowledges that there are likely to be many other influences on individuals' beliefs and values, such as nationality. However, it is suggested that some relationship between organisational culture and BRB is likely to exist.

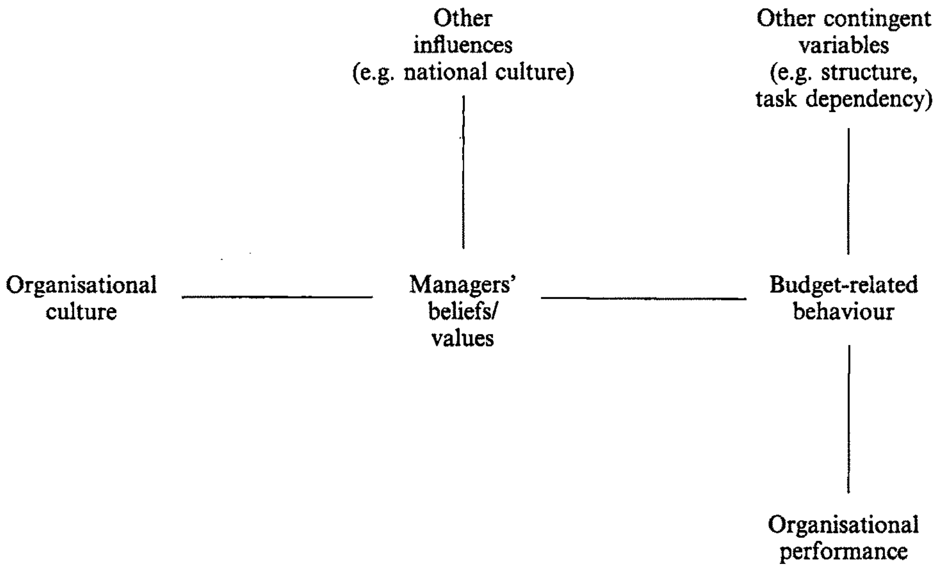
As there is no previous research in this area, the study is an exploratory case study, concerned with whether two or more variables are related. In such case studies, Bryman (1989) suggests, 'hypotheses...may be of a greater level of generality (and therefore more exploratory) than is typically associated with a "scientific" hypothesis'. He cites the Aston Studies examples, where the hypotheses formulated were 'extremely general'. Such general hypotheses are probably better referred to as research questions.

The principal research questions to be explored in this paper may be summarised as:

1. Is there a correlation between managers' perceptions of organisational culture and BRB?
2. What are the most important aspects of any correlations?
3. Is there any evidence of tension between culture and the financial control system?
4. Is research informed by a functionalist methodology useful in the study of this relationship?

To explore these questions, organisational culture was measured in terms of managerial perceptions of their workplace; and BRB in terms of the

Figure 2
Contingency model of research domain


Other influences (e.g. national culture)
Other contingent variables (e.g. structure, task dependency)
Organisational culture
Managers' beliefs/ values
Budget-related behaviour
Organisational performance

variables identified in previous research. The relationship between organisational culture and BRB could then be examined by an analysis of possible correlations. Moreover, to pursue the possibility of tension existing between the financial control system and managers' values, managers were asked about BRB as it was currently practised, and how they thought it should be practised (for ease of reference these are referred to as 'actual BRB' and 'ideal BRB'). The difference between the two could be an indication of the extent to which tension might be present. If no tension exists, one would expect the actual BRB to be close to the ideal BRB. However, it must be accepted that managers could perceive an acceptable shortfall between actual practice and their ideal, on pragmatic grounds. If this were so, one might expect the shortfall to be reasonably consistent across all aspects of BRB.

2.2. *Research Site*

The site was a large UK county council structured into service departments including education, libraries, social services, highways, planning, legal, information systems, administration and fire. The Education Department was excluded from the study as it was developing its own separate budgetary control system. Excluding the Education Department, some 10,000 people were employed by the organisation, and the operational budget was about £100m. The focus of the study was on those managers with some budgetary responsibility, totalling 417, of whom 186 responded to a questionnaire.

For many years, the organisation had operated a highly-centralised budgetary control system. The system was managed by a Treasurer's Department, which comprised accountants who had responsibility for specific service budgets. These accountants would construct detailed budgets within corporate guidelines agreed by chief officers and senior politicians. Senior managers in service departments would be consulted over marginal changes to the budget. Control of expenditure against budgets was in the first instance the responsibility of the Treasurer's accountant, who would then seek explanations from service managers.

Responsibility for budgeting within service departments, such as it was, was variable, with some service departments involving junior managers more than other departments. The organisation was in the early stages of changing this system by extensive decentralisation of budget setting and control. The research was concerned with managers' BRB with respect to the centralised control system.

2.3. *Data Collection*

The principal method of data collection was by way of a two-part questionnaire. The first part was concerned with respondents' perceptions of workplace culture and the second with the workplace BRB.

Questionnaires to determine organisational culture found in the literature were often insubstantial, asking a few rather bland questions, and were considered inappropriate to try to measure such a complex social phenomenon. The cultural questionnaire used here was developed from Reynolds (1986), who based his questionnaire on aspects of culture discussed by Ansoff (1979), Deal and Kennedy (1982), Harrison (1972, 1978), Hofstede (1980) and Peters and Waterman (1982). The resulting 27 cultural variables were far more extensive than any other questionnaire found in the literature.

Reynolds identified 14 dimensions of culture such as 'external versus internal emphasis, task versus social focus etc.'. Two additional dimensions were added in this study to reflect the local government environment. The first asked whether professional or managerial competence dominated in the workplace, and the second whether councillors (elected members) or officers (salaried managers) dominated. These 16 dimensions, listed in Table 1, were measured directly, with five item responses forming a continuum, and respondents were asked to circle the item that most closely described their workplace. For instance, one dimension is concerned with perceived risk attitudes, and respondents were asked to select one of the following statements as most accurately describing this aspect of their workplace:

1. No risk of any kind is ever taken.
2. There is a willingness to accept a minimal risk.
3. Familiar and predictable risks are acceptable.
4. There is some acceptance of unfamiliar risk.
5. Any kind of risk is readily accepted.

These 16 dimensions are concerned principally with perceived management practices and are most closely associated with corporate culture as classified above.

A second section of the questionnaire measures the perceived basis for commitment, or motivations to work, of colleagues in the workplace. Reynolds' original motives included financial rewards, prestige and respect, personal development, work conditions, opportunity to change and improve things, social aspects and challenging work. To these were added: commitment to public service, commitment to caring, being a manager and taking a business-like approach—to reflect the issues in the contemporary local government environment. Respondents were asked to indicate the relative importance of each of the motivators to their colleagues, on a five-point, Likert scale.

These dimensions might be considered as colleagues' perceived beliefs, and are more closely associated with the organisational climate as outlined above.

The final part of the questionnaire was designed to determine BRB. The original full questionnaire was developed by Fertakis (1967) and modified by Swieringa and Moncur (1974) and Merchant (1981, 1984), to comprise 44 statements concerning budget-related activities. Bruns and Waterhouse (1975) found 13 significant factors underlying the activities, and 10 of these were replicated by Williams, Macintosh and Moore (1990).

The questionnaire used in this study comprised 10 questions, which are outlined in Table 2. These 10 questions were developed from the factors reported by Bruns and Waterhouse (1975) and Williams, Macintosh and Moore (1990). Respondents were asked to signify their perceptions of existing budgetary behaviour and their perceptions of what would be ideal behaviour in their workplaces.

General information was also collected concerning gender, age, educational attainment, and actual and expected length of stay in the organisation. The questionnaire was piloted to 25 managers to ensure comprehension, and a few minor changes were made as a result. Some of the original Reynolds wording was amended for use in the UK.

3. Analysis of responses

The analysis of responses is presented in three stages. In this way, an analysis of the complex relationship between culture and budget-related behaviour can be methodically constructed. First, the raw means and standard deviations are discussed. Second, the results of a factor analysis of the cultural questionnaire are discussed. These first two stages enable a picture of the organisational culture to be determined. Finally, the results of the canonical correlations between the factor scores from the cultural questionnaire and the BRB responses are discussed. This final analysis establishes the relationship between beliefs and values and BRB at the level of the individual manager.

3.1. Means and Standard Deviations of Questionnaire Responses

Table 1 shows the mean responses and the standard deviations of the two sections of the cultural

Table 1
Mean responses and standard deviations to cultural questionnaire

	Mean	*Standard deviation*
Knowledge about workplace	3.74	1.06
Knowledge about objectives	4.20	0.74
Cooperation rather than competition in workplace	3.92	1.00
Risk attitude	3.34	0.89
Diversity of staff	3.52	0.72
Decentralised decision-making	3.16	0.96
Emphasis on task over people	2.41	0.83
Formalisation of workplace	2.23	0.73
Family/organisation priority	2.83	0.93
Client/organisation priority	2.46	0.95
Extent to which planning occurs	3.69	0.72
Extent of change in workplace	3.69	1.04
Rewards based on group or individual performance	3.80	0.89
Extent of group decision-making	2.85	0.84
Professional/manager-dominant	2.70	0.93
Dominance of councillor/manager	3.89	0.66
Commitment to public service	3.80	0.74
Work conditions	3.09	0.80
Financial reward	3.09	0.95
Personal growth and development	3.56	0.76
Commitment to caring	3.89	0.96
Social aspects of work	2.73	0.88
Prestige gained from work	2.99	0.99
Importance of being a manager	3.32	0.76
Taking a businesslike approach	3.34	0.89
Importance of challenging job	3.57	0.77
Opportunity to improve services	3.67	0.76

Table 2
Mean responses and standard deviations from budget-related behaviour (BRB) questionnaire

	BRB in practice		*Ideal BRB*		*Difference in means**
	mean	*s.d.*	*mean*	*s.d.*	*mean*
Participation in budget setting	2.11	1.25	4.19	0.98	2.08
Participation in explaining variances	2.25	1.20	4.00	0.98	1.75
Explanations of variances required	2.38	1.23	3.89	1.09	1.51
Budget allowed flexibility/innovation	2.05	1.18	4.02	1.07	1.97
Budget useful for managerial role	2.61	1.34	4.17	0.95	1.56
Budget pressure from superior	2.58	1.28	3.35	1.19	0.77
Budget manipulation occurs	2.55	1.42	3.52	1.32	0.97
Budget takes up a lot of time	2.13	1.24	3.29	1.22	1.16
Finance Department assistance received	1.99	1.27	3.23	1.48	1.24
Ability to manage budget is important factor for performance review	2.27	1.29	3.83	1.07	1.56

Notes: Responses were provided on a five-point Likert scale, with 1 indicating no such BRB and 5 indicating a great deal.
*T-tests indicate that the differences in means between the actual and ideal BRBs were statistically different (prob$<$0.001) at the 95% confidence level for all variables.

questionnaire. These results are used below, in conjunction with a factor analysis, to obtain an analysis of the culture within the whole organisation. Table 2 shows the mean responses and standard deviations from the BRB questionnaire. The difference between the two scores for BRB as it was being practised, and how it would be in an ideal world, is a crude indication of the existence of possible tension. The scale for this difference ranges from 0 to +4, with 0 indicating no tension and +4 indicating a great deal of possible tension.

Theoretically, negative differences could occur if managers perceive that actual BRB exceeds their ideal, but this is extremely unlikely as it is not rational.

The responses indicate generally high differences, all variables showing scores $>$ 0. The largest difference is evident with respect to the level of participation and the extent to which budgeting facilitated flexibility and innovation. These relatively large differences indicate the existence of some possible tension. It is also interesting to note that the standard deviations of the ideal responses were less than those associated with current practice (except for one variable). This could be due to there being broad agreement among managers as to what constitutes a good budgeting system, but differences occur in practice throughout the organisation.

3.2. Factor Analysis of Cultural Variables

To aid interpretation, the organisational cultural variable set was reduced from 27 variables to 10, using SAS factor analysis. Ten factors were extracted with eigenvalues greater than one, which accounted for 66.6% of the total variance. The factor loadings and the precentage of variance explained by these factors after varimax rotation are shown in Table 3. An analysis of these factors, in association with the mean response scores in Table 1, enables a broad description of the organisational culture to be attempted. The organisation clearly displayed 'traditional' public sector values associated with a common sense of purpose and direction related to public service provision, provided in a management climate of cooperation where staff were not strongly motivated by hygiene factors. There was also a sense of the acceptance of uncertainty in the organisation, with risks being taken within an informal and decentralised setting. The organisational focus was more external than internal, with an emphasis on caring for clients and the family rather than internal organisational issues. There was also a recognition of managerial and private sector practices, with an emphasis on planning and organisational change and a belief that more attention was being given to task rather than people, and to individuals rather than groups. Overall, the organisation seems to comprise two significant sub-cultures. The first, and most dominant, is a culture that values public service management and is concerned with the social aspects of the organisation. This might be characterised as a 'humanist' culture. The second culture values managerialisation and private sector attitudes and practices, and might be characterised as a 'managerialist' culture. This is a reflection of the literature which juxtaposes the traditional public sector bureaucrat with the 'new' local government manager (Stewart, 1986).

Table 3
Factor analysis of cultural variables reported in Table 1

Factor	*Title and dimensions loading>0.4*	*Percentage of Loading*	*Variance*
1.	Public service management		14.0
	Knowledge about workplace	0.66	
	Knowledge about objectives	0.65	
	Cooperation rather than competition in workplace	0.62	
	Commitment to public service	0.57	
2.	Personal motivations to work		9.3
	Work conditions	0.76	
	Financial reward	0.76	
	Personal growth and development	0.67	
3.	Acceptance of uncertainty		7.6
	Risk attitude	0.76	
	Conformity of staff	0.65	
	Centralised decision-making	0.63	
4.	Concern for social aspects		6.3
	Commitment to caring	0.76	
	Social aspects of work	0.66	
	Emphasis on people over task	0.46	
	Formalisation of workplace	0.44	
5.	External/internal focus		5.5
	Family/organisation priority	0.80	
	Client/organisation priority	0.55	
	Prestige gained from work	0.49	
6.	Response to managerialisation		5.2
	Importance of being a manager	0.77	
	Extent to which planning occurs	0.64	
	Taking a business-like approach	0.53	
7.	Response to private sector practices		4.6
	Extent of change in workplace	0.71	
	Importance of challenging job	0.61	
	Rewards based on individual performance	0.53	
8.	Importance of group working		4.3
	Group decision-making	0.78	
	Emphasis on people over task	0.51	
	Group rewards	0.40	
9.	Professional versus managerial competence		4.1
	Professional/managerial dominance	0.79	
10.	Councillors versus officers		3.8
	Dominance of councillors/managers	0.83	

3.3. Correlations Between Culture and BRB

Table 4 shows the correlations between the cultural factor scores and the BRB variables. The individual correlations are generally very low, but it can be seen that some cultural factors show more correlation than others, as do some budget variables. However, these results are not surprising, as culture and behaviour are both complex attributes, and an analysis between the complete sets of variables is required to see whether, overall, there is a relationship.

This relationship was analysed using the multivariate technique, canonical correlation analysis, from the SAS package. Williams, Macintosh and Moore (1990) advocated the use of multivariate canonical analysis as a way of identifying underlying structures of contingent relations between organisational level variables and characteristics of management accounting and control systems.[1]

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[1] Broadly, this analysis can be employed to investigate the extent to which one set of two or more variables can predict or explain another set. Given two sets of variables, the procedure finds a linear combination from each, called a canonical variable, so that the correlation between the two canonical variables is maximised. This first correlation is followed by a search for a second set of canonical variables, uncorrelated with the first pair, which produces the second highest correlation coefficient. The process continues as many times as there are variables in the smaller group. The coefficients of the linear combinations are canonical coefficients (normally standardised so that each canonical variable has a variance of 1). Analysis of these coefficients provides an assessment of the contribution single variables make to both sets of variables. In this paper, the two sets of variables are the two parts of the questionnaire relating to organisational culture and BRB.

Table 4
Correlations between cultural factors and budget-related behaviour variables as practised

					Cultural factors					
BRB variables	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
Participation - setting	0.05	0.07	0.18	−0.27	0.23	0.10	0.08	0.03	−0.15	0.01
Participation - variances	0.04	0.03	0.21	−0.23	0.02	0.09	0.15	−0.07	−0.07	−0.12
Explaining variances	0.01	−0.01	0.13	−0.05	0.03	−0.02	0.00	0.02	−0.08	0.08
Flexibility/ innovation	−0.05	−0.05	0.12	−0.16	0.04	0.11	0.00	0.01	−0.04	0.11
Managerial role	−0.03	0.00	0.15	−0.08	0.02	0.14	−0.06	−0.02	−0.51	−0.03
Budget pressure	0.02	0.03	0.15	−0.01	0.08	−0.05	0.01	0.10	−0.01	−0.12
Budget manipulation	−0.09	−0.08	0.27	−0.05	−0.03	0.06	0.05	0.02	0.05	−0.02
Time taken	0.00	−0.07	0.31	−0.18	0.07	0.07	0.00	0.10	0.11	0.06
Finance dept. assistance	−0.09	−0.03	0.12	−0.14	0.10	0.13	0.04	0.01	−0.07	−0.02
Performance review	−0.04	0.02	0.21	−0.10	0.26	0.15	0.10	0.15	0.03	−0.03

Two canonical correlations were carried out. The first examined the relationship between the 10 cultural factors and BRB as it was currently practised. The second examined the relationship between culture and BRB as respondents believed it should be practised. In both correlations the factor scores from the factor analysis were used for the 10 cultural factors. A summary of the results is shown in Table 5.

An important advantage of canonical correlation analysis is its ability to explore gestalt relationships. This is particularly useful in the study of organisational culture and BRB, which are both gestalt social phenomena. A gestalt analysis can be undertaken by an examination of the canonical coefficients of each set of variables.

3.3.1. Organisational Culture and Existing BRB

This analysis found one significant function (p = 0.0005) with a reasonably large correlation (canonical correlation coefficient = 0.56) between organisational culture factors and BRB as it was currently perceived to operate. This means that there is a correlation, and possibly therefore also a contingent relationship, between managers' perceived workplace beliefs and values, and the BRB as seen by those managers.

An examination of the standardised correlation coefficients (Table 5) underlying this function can assist the gestalt analysis by assessing the importance of each cultural and BRB variable to the overall correlation. The size of the coefficient is an indication of this importance. However, care must be exercised when comparing coefficients across variable sets, as each coefficient represents the importance of that variable in relation to the other set of variables considered simultaneously.

An examination of the standardised canonical coefficients for the cultural factors relationship with BRB as it is currently practised (Table 5) shows that the internal/external focus is the most important factor, followed by the concern for social aspects (the negative direction of the coefficient for concern for social aspects results from the way the original statements were arranged, with high concern scoring highly) and the importance of group working. Together, all these factors are concerned with the importance of people and relationships, and are consistent with the 'humanist' sub-culture identified above. The next most important cultural coefficients are those concerned with acceptance of uncertainty and response to managerialisation. These factors are consistent with the 'managerialist' sub-culture identified above.

The BRB variables most highly correlated with the cultural factors are participation in budget setting, ability to manage the budget as a measure of performance, participation in explaining variances, and the usefulness of the budget to managerial role. There appear to be two factors underlying these variables; the first concerning participation and the second concerning the importance of budgets to respondents' managerial roles.

Further analysis suggests two possible underlying gestalt relationships between the two sets of variables. The first, and apparently most dominant, concerns the relationship between people-orientated, highly-socialised managers, and participation in budgeting. The canonical coefficients indicate an inverse relationship, with low

Table 5
Results of canonical correlations between culture and BRB

Variables	*Standardised canonical coefficients*	
	Existing BRB	*Ideal BRB*
Organisational culture		
Public service management	0.03	−0.10
Personal motivation to work	0.13	0.19
Acceptance of uncertainty	0.26	0.41
Concern for social aspects	−0.38	−0.24
External/internal focus	0.77	0.45
Response to managerialisation	0.23	0.67
Response to private sector practices	0.06	0.14
Importance of group working	0.33	−0.23
Professional v managerial competence	−0.08	0.01
Councillors v officers	0.09	−0.08
Budget-related behaviour		
Participation in budget-setting	0.93	0.26
Participation in explaining variances	0.46	0.23
Explanations of variances required	0.11	0.22
Budget allowed flexibility/innovation	0.18	0.34
Budget useful for managerial role	0.37	0.28
Budget pressure from superior	0.14	0.16
Budget manipulation occurs	0.24	0.40
Budget takes up a lot of time	0.20	0.36
Finance department assistance received	0.16	0.26
Ability to manage budget is important	0.83	0.92
Canonical r	0.56	0.51
Wilk's Lambda	0.33	0.37
Number d.f.	100	100
Den d.f.	935	935
Probability	0.0005	0.0081

scores on participation being correlated with high scores on external orientation and socialisation. The mean response to the extent to which participation occurs in practice was only 2.11 (Table 2), and this suggests that tension exists in the organisation between culture and budgeting practice. This is also evident in the tension with respect to existing participation levels, as indicated by the high difference between current practice and ideal practice (Table 2). This relationship is consistent with the analysis of organisational culture discussed above. The people-orientated, highly-socialised managers are displaying the cultural attributes of the 'humanistic' sub-culture. This sub-culture is therefore strongly associated with a 'participative' budgeting style, and if this style is not present, tensions exist within the organisation.

The second, less dominant, relationship was between managers concerned with an acceptance of uncertainty and a positive response to managerialism; and the ability to manage the budget and the usefulness of budgeting in respondents' managerial roles. In this relationship, managers are displaying cultural attributes of the 'managerialist' sub-culture. The 'managerialist' sub-culture is therefore associated with what might be termed a 'managerial' budgeting style.

Analysis of the variables with standardised correlation coefficients close to zero is also interesting, as these indicate variables with little or no contribution to the overall correlation. The cultural variables with such low coefficients are those concerned with public/private sector management practices. This is consistent with previous research discussed above, showing no real difference in BRB between public and private sector managers.

3.3.2. *Organisational Culture and 'Ideal' BRB*

A significant ($p = 0.0081$) correlation (can. corr. coeff. = 0.507) also existed between organisational culture and perceived ideal BRB. However, analysis of the standardised canonical coefficients in Table 5 indicates a reversal in influence of the two gestalt relationships identified above. The cultural factors contributing most to the canonical variable are response to managerialisation, internal/external focus and acceptance of uncertainty, i.e. those associated with the 'managerialist' sub-culture. It is, however, interesting to note that the factor which directly addresses the relative importance of professional and managerial competence has almost no correlation with BRB. This may be due to the over-simplification of the original question, which elicited a neutral response (mean 2.70).

The budget-related variables most correlated with culture are the ability to manage budgets, the existence of budget manipulation, the time taken for budgeting, and the extent to which budgeting allows flexibility and innovation. However, nine of the 10 variables had coefficients in excess of 0.20, indicating that all these factors were correlated with culture. The exception was budget pressure from superiors. These results can be interpreted as identifying a 'managerialist' sub-culture which perceived budgets to be an important part of being a manager, and thought they should be flexible and enabling rather than mechanisms of controlling activities. Such BRB is similar to, and extends the definition of, the 'managerial' budgeting style found in the current budgeting system.

In conclusion, the dominant gestalt relationship with respect to 'ideal' BRB is between the 'managerialist' sub-culture and a 'managerial' budgeting style. The dominance of the managerial gestalt relationship may well be due to the general direction of cultural change within the organisation. This change was evident from a series of interviews with senior managers who were trying to change the organisation from a traditional, professionally-led, bureaucratic culture to a managerial, business-like culture (Goddard, 1993). Managers appear to be idealising BRB to conform to this new culture.

4. Discussion and conclusion

The contributions of this research may be discussed by reference to the original research questions.

1. Is there a correlation between managers' perceptions of organisational culture and budget-related behaviour?

The canonical correlation analysis indicates a quite strong relationship between managers' perceptions of workplace culture and BRB at the level of the individual manager. The analyses of means and the cultural factor analysis lend strong support to the existence of an organisational culture, which indicates quite strong shared beliefs among managers. Taken together, these analyses establish the influence of organisational culture on BRB. This is an important contribution, because previous literature has suggested such a relationship, but it has not been established empirically. The research clearly establishes organisational culture as a valid contingent variable.

This finding also has important practical implications. In particular, it is evident that budgetary control systems will only be really effective if they are designed to complement organisational culture. At least, their practical operation can only be understood if the relationship is analysed.

In the organisation studied, two sub-cultures were evident. The first was the 'humanist' culture, concerned with the organisation's social aspects and with the importance of public service. The second was an emerging 'managerialist' culture associated with managers who displayed a positive response to managerialisation and an acceptance of uncertainty. The principal effects of these values and beliefs on BRB were that the 'humanist' culture was associated with a 'participative' budgeting style and the 'managerialist' culture with a 'managerial' budgeting style. Figure 3 illustrates and summarises the findings of the research in terms of the original research model.

2. What are the most important aspects of any correlations?

Although canonical correlation analysis has been used before in accounting and management research, the contribution of this research is to use it to enable the complex nature of the relationship between culture and BRB to be explored in more detail. Figure 3 provides a summary of the gestalt relationships that were found to exist, and the underlying attributes of culture which were associated with particular aspects of BRB.

The canonical correlations also indicated that the values embodied in the 'humanist' sub-culture resulted in low perceptions of participation. In such a culture, a financial control system demands a high degree of participation to operate effectively. Indeed, organisational culture may be an explanatory contingent variable for the contradictory findings of the participation in the budgeting and budget style literature.

The canonical correlations also indicated that the values embodied in the 'managerialist' culture were associated with the ability to manage and manipulate budgets, their time-consuming nature and their role in promoting flexibility and innovation. This was most evident with respect to managers' perceived ideal BRB. 'Managerialist' cultures clearly demand financial control systems that support the managerial role. Research into different organisations might well establish different relationships and help to build a more comprehensive understanding.

The shared belief/value termed 'external focus' was evident in both cultures, as it produced a relatively high standardised canonical coefficient for both existing and ideal BRB. This may be due to the underlying cultural variables that form this factor, as shown in Table 3. Prioritising the family

Figure 3
Schematic representation of research findings

Organisation culture	**Managers' beliefs/values**	**Budget-related behaviour/style**
Humanist	External focus Concern for social aspects Importance of group working Public service management	**Participative style** Participation in budget-setting Participation in explaining variances
Managerialist	Positive response to managerialism Acceptance of uncertainty External focus	**Managerial style** Ability to manage budget is important Budget manipulation occurs Budget takes up lot of time Budget allowed flexibility/innovation Budget useful for role as manager

rather than the organisation is consistent with the 'humanist' culture, and prioritising the client rather than the organisation is consistent with the 'managerialist' culture. Moreover, it was clear that in the organisation studied, both sub-cultures existed alongside each other and were evolving over time. This places great demands on the budgeting system to evolve in tandem, to meet the needs imposed by new cultural developments.

3. Is there any evidence of tension between culture and the financial control system?

Another of the paper's contributions was to provide empirical evidence in support of Flamholtz and Markus and Pfeffer's hypothesis that when a financial control system is incompatible with organisation culture, it will meet resistance and eventually fail. There was a good deal of evidence of a mismatch between the 'humanist' culture, valuing people and relationships, and the extent of budgetary participation; and to a lesser extent between the 'managerialist' culture and management of budgets. The highly-centralised financial control system in operation fell short of managers' ideals in these respects. Indeed, the organisation was aware of these tensions and was in the process of designing a new highly-decentralised system. This lends some support to Flamholtz and Markus and Pfeffer's hypothesis.

4. Is research informed by a functionalist methodology useful in the study of this relationship?

The research also makes a contribution to the paradigmatic debate concerning management accounting research. Much of this debate focuses on the shortcomings of contingency theory in particular and the functional paradigm in general. Many of these shortcomings, which may be categorised as technical or conceptual (Ezzamel and Hart, 1987), were evident in this study. A major technical problem encountered concerned the measurement of the contingent variables. Few satisfactory instruments exist for measuring culture. However, the Reynolds questionnaire was the most thorough, and incorporated most of the aspects of culture found in the literature, albeit at the cost of having to use 27 variables to describe culture. These were reduced to 10 factors to aid analysis. The BRB variables were themselves based on factors derived from a larger set of variables. Inevitably, such reduction of data results in some loss of information.

Other technical problems concern the use of canonical correlation analysis. This technique is extremely useful in analysing complex relationships between groups of variables, but the interpretation of the results has to be undertaken with care. However, it is difficult to see how such complex relationships can otherwise be analysed. As with most contingency theory studies, the correlations found were significant, but quite low. However, the theory now accepts that many contingent variables exist, each of which may make only a relatively low contribution. Finally, the research was inevitably static, producing only a snapshot of the relationship. It is hoped to rectify this problem to some extent by repeating the research in a few years.

The conceptual problems of the approach are more fundamental. Many researchers would argue that culture can only be studied within an interpretive paradigm. Smircich (1983) summarises this position as studying organisations as if they are cultures; culture being something the organisation is, not something it has. Such an approach would also overcome the deterministic and static nature of the contingency model used here. Interpretive research into the relationship between culture and financial control (Dent, 1991; Broadbent, 1992) reveal the social processes whereby financial control systems interrelate with culture and are both constitutive and reflective of culture. However, these approaches are themselves fraught with problems of both validity and interpretation of data, and also generalisability (Ferreira and Merchant, 1992). Indeed, there is great debate within ethnographic research in anthropology (Aunger, 1995) and social science (Hammersley, 1992) concerning the validity of the approach.

It is evident that both paradigmatic approaches have strengths and weaknesses. Boland and Pondy (1983) propose a 'genuine union of rational and natural systems'. This is the 'recognition that each way of understanding organisations serves as a context for the other'. In other words, 'subjective experience, once externalised, confronts us as objective reality and no rational model can escape its inherently symbolic and interpretive nature'. The research reported in this paper might therefore be seen as complementary to a more interpretive approach, and may bring some additional understanding of culture and control. It provides empirical evidence of the 'objective reality' and of the existence of a relationship between culture and BRB. Moreover, the methodology is capable of replication in other organisations to further test the theoretical relationships examined here. Indeed, the research has resulted in further induced theoretical relationships, which can be tested in future research. For instance, the relationships between a social/caring culture and budgetary participation, and between a more managerial culture and budget practice, could be further tested in other organisations. It may also be induced that in different cultural settings, different relationships are likely to exist. A study examining these relationships is currently underway, comparing the culture-budget related behaviour relationship in other local government organisations and in different national cultures.

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Political and Industrial Relations Turbulence, Competition and Budgeting in the Nationalised Jute Mills of Bangladesh

Zahirul Hoque and Trevor Hopper*

Abstract—This paper reports an empirical investigation, based on triangulation methods, of how a set of environmental facts affect budgeting characteristics in the nationalised jute mills of Bangladesh. The key factors were derived from intensive fieldwork. Five external factors (political climate, industrial relations, competition, aid agencies and government regulations) were deemed to affect budget-related factors (such as participation, accountability for budget, budget evaluation, budget analysis, interactions among managers and budget flexibility). Data from 38 state-owned jute mills within the Bangladesh Jute Mills Corporation (BJMC) are used to test the propositions. The analyses of data reveal a significant relationship between environmental factors and budget-related behaviour. Political factors, industrial relations and market competition were major influences on how budgeting systems were perceived. The study shows how political volatility and industrial relations can render the formal systems of budgeting and controls ineffective for internal management despite worthy intentions. On the other hand, when managers believed external competition on their mill to be great, they perceived budgeting more positively.

1. Introduction

Considerable effort has gone into researching the design of budgetary control systems, managers' usage and satisfaction with them, and whether systems are an expression of management styles (Lawler and Rhode, 1972). This led researchers to apply contingency theories of organisation developed by Burns and Stalker (1961), Woodward (1965) and Lawrence and Lorsch (1967) to accounting (Chenhall and Morris, 1986; Ezzamel, 1990; Gordon and Narayanan, 1984; Merchant, 1981, 1984; Mia, 1993; Otley, 1978; Williams et al., 1990). These studies have led to a greater understanding of how budgetary control systems are affected by organisational circumstances such as size, authority structures, culture, technology and task uncertainty, strategy, and environmental factors (for a review, see Otley, 1980; Emmanuel et al., 1990; Briers and Hirst, 1990).

Early contingency theory isolated the state, trade unions and political parties as important factors bearing on organisational controls (Dill, 1958; Miles and Snow, 1978). However, subsequent contingency studies of budgeting either ignored such factors by conceiving external variables in terms of markets or technology, or subsuming their measurement and effects as one component within a single measure of environmental uncertainty (Ezzamel, 1990). Thus institutional factors have become de-emphasised within contingency research despite being intertwined with problems of day-to-day management in some organisations. This is particularly so in nationalised trading corporations where organisational controls and regulatory structures are invariably connected to the body politic. When nationalising major industries such as coal, steel and public utilities, the UK's 1945 Labour government established boards for each statutory corporation appointed by the government. Politicians were expected to concentrate on policy, with professional managers having the commercial freedom to execute it. This never worked as intended, mainly because politicians intervened on detailed operational issues but failed to formulate clear and consistent policies (Robson, 1960; Tivey, 1966).

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Many developing countries embarked on nationalisation programmes within centrally planned programmes of social and economic development. In former British colonies, the organisation of nationalised industries was often modelled on UK legislation, with similar, but more acute, consequences to their UK counterparts. Statutory corporations in developing countries often have greater centrality to economic development, and operate within less stable political systems with reduced checks and balances on political intervention. For example, Ouibrahim and Scapens (1989) found that accounting played a peripheral role in the management of the nationalised Algerian construction industry because of prevailing socio-economic factors. More generally, Wildavsky (1975) chronicles a series of failures of rational accounting procedures in developing countries because of their conflict with prevailing ethoses and methods of political resolution.

This paper addresses management control problems in an underdeveloped country[1] via an examination of management accounting in the nationalised Bangladesh Jute Mills Corporation (BJMC)—a statutory corporation organised along Westminster lines, i.e. the establishment of a statutory corporation formally organised similarly to private corporations whereby government-appointed managers are given delegated powers to execute policy and aims determined by government. Its 38 mills manufacture a variety of jute products including: hessian and sacking cloth, carpets, carpet backing cloth, twine and spindles. The research primarily used case study methods and grounded theory to glean how budgets were used in practice and the meanings attached to them. This demonstrated how problems associated with budgeting in nationalised corporations elsewhere were found in an acute form in BJMC. Budgeting tended to be performed in a ritualistic and rule-bound manner to meet government requirements. The accounting systems were formally and technically models of conventional best practice, but their contents bore little resemblance to operational realities. Consequently, they were ignored by managers, who nevertheless believed they had the potential to assist them under different circumstances.

2. Triangulation

The research consisted of three interrelated stages. The first was a pilot study based on interviews and supporting documentation. The second stage was in two parts: an intensive case study of the largest mill within BJMC—Adamjee—and a questionnaire study directed to all 38 mills within BJMC on budgeting and environmental issues identified in the pilot study. Triangulation methods were used incorporating survey research in a contingency vein to extend and validate the results of the two qualitative research stages. It is claimed (Denzin, 1978; Jick, 1979) that a triangulation strategy can help researchers capture a comprehensive, holistic and contextual portrayal of the social phenomena under study (Vidich and Shapiro, 1955; Webb et al., 1966; Bouchard, 1976). Various types of triangulation can be employed for studying management accounting: namely, theory triangulation, data triangulation and investigator triangulation. Investigator triangulation was not used in this study because of practical constraints; consequently it is not discussed further. Nevertheless, it has several benefits, including improved validity of data.

Theory triangulation involves using factors from different theoretical perspectives simultaneously.[2] By taking advantage of the complementariness of different theories, accounting researchers can conduct a more holistic analysis and gain alternative interpretations of the same phenomena (Ansari and Euske, 1987; Berry et al., 1991; Carpenter and Feroz, 1992). A substantive methodological criticism of contingency research is its neglect of the importance of processes and subjective meanings within budgeting (Otley, 1980; Cooper, 1981; Covaleski and Dirsmith, 1983;

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[1] The paper does not argue that management control in developing countries is distinct from that in developed economies. Contextual variables are often similar, though they may vary in importance. In addition, there is considerable infusion of management methods and structures to former colonies from the imperial power, as was the case in this research. The organisation of BJMC was modelled on UK statutory corporations and its accounting systems were based on UK practice, including the management accounting system, which formally followed conventional western practice. It would be wrong to assume that results obtained in a developing country are not relevant to research and practice in developed economies and vice versa.

[2] A discussion of the epistemological and ontological problems of simultaneously using 'interpretive' and 'scientific' approaches is beyond the scope of this paper. However, a statement of the authors' methodological position is due. Briefly, this is that integration of theories and results based on 'interpretive' theories and allegedly 'scientific' research, such as contingency theory, is probably philosophically impossible. Similarly, any ultimate proof of the superiority of either approach is impossible given the current state of the philosophy of science. Such circumstances call for a degree of theoretical relativism and pluralism, especially as users can often simultaneously use insights from methodologically conflicting studies to inform everyday behaviour. Proof and knowledge is ultimately a social product of convincing relevant experts of the veracity of one's story (see Chia, 1996, for discussion of this within a post-modernist perspective). Within a pluralistic social science this may be done in a variety of ways that complement and mutually inform one another without necessarily being theoretically integrated. Ultimately, how best to use results from different methodologies resides in the user's evaluation of whether they reasonably inform the problem under scrutiny.

Hopper and Powell, 1985; Berry et al., 1985; Hopper et al., 1986; Hopper et al., 1987). Contingency research has tended to exhibit an over-reliance on arm's length research methods, which is manifested by the number of questionnaire studies statistically testing variables derived from previous research. On the other hand, contingency research can assist qualitative research problems. For example, the latter often reveals the importance of institutional factors, such as the state, trade unions and markets, on accounting but, because of its focus on internal organisational processes, it is unable to fully and systematically explore them. Often this requires more aggregated quantitative methods based on surveys or published data sources. If accounting research is to advance, there is a strong case for allying qualitative research to contingency and markets studies, for example, to generate new but grounded variables into contingency research and to validate its findings.

Data triangulation involves using a variety of data sources within a single study (Denzin, 1978). The strategy mixes both qualitative and quantitative methods, including interviews, participant observations, shadowing, documentary evidence and questionnaires (Gross et al., 1971; Yin, 1981) to help generate a rich source of field data with internal checks on its validity. Both contingency theory and qualitative methods have problems in this respect (Halfpenny, 1979; Jick, 1979; Van Maanen, 1979; Morgan and Smircich, 1980; Covaleski and Dirsmith, 1990). Contingency research often fails to check out whether its models and results are consistent with actions on site, or individual subjective meanings. Both of these issues are best investigated through qualitative methods. However, qualitative methods can be problematic—for example, the researcher's detachment and, if more than one researcher is involved, problems of multiple interpretations, give cause for concern regarding the reliability and validity of results. Silverman (1985) suggested that qualitative researchers improve the quality of their data by collecting quantitative data on the same phenomenon if available. This can assist fieldwork in several ways, including the correction of the holistic fallacy (the field observer's tendency to perceive all aspects of a social situation as congruent), demonstrating the generality of a single observation, verifying field observations and casting new light on them by bringing in data not easily traced in field research (Sieber, 1973). Moreover, a research strategy embracing quantitative and qualitative techniques can, as Lukka and Kasanen (1995) argue, alleviate the generalisation problems of case study research in accounting.

3. The research propositions[3]

From the outset, the researchers believed that a grounded approach was the most appropriate one for examining how budgetary control worked in practice. During the pilot study, it became evident that environmental factors were major influences on managers' perceptions of budgetary processes within BJMC. The framework, derived from initial fieldwork, which informed the design of the subsequent questionnaire study, is presented in Figure 1. This is a simple uni-directional model, which postulates that the budget's characteristics are environmentally determined. The authors sympathise with allegations that contingency theories have often over-emphasised environmental determinism, and neglected managerial choices and environmental manipulation (Hopper and Berry, 1983). However, in this case, the field research indicated that managers' scope to indulge in such activities was minimal given their lack of power in the face of external interventions by ministry officials, politicians and trade union officers. An advantage of triangulation methods is that static quantitative research can be enriched by qualitative analysis that is attendant to causality and dynamics.

The variables in Figure 1 were derived from field observations rather than prior research. In the case of the environmental variables, this meant that tailor-made questions directed to the specific circumstances could be devised. In retrospect, more commonplace batteries of questions from previous contingency studies might have been used. However, they tend either to ignore the key environmental variables identified in this study or to subsume them as facets within different categorisations of uncertainty. Our approach had the advantage that variables derived from the research site were unambiguously tested to validate fieldwork results. With hindsight, it had weaknesses: the failure to use standard tests of environmental factors delimited opportunities to compare and contrast the results of this study with other contingency research. This issue is examined further in the concluding discussion.

Figure 1 conjectures that strong managerial perceptions of political and industrial relations factors, and government rules and regulations affecting the performance of their mills, would be

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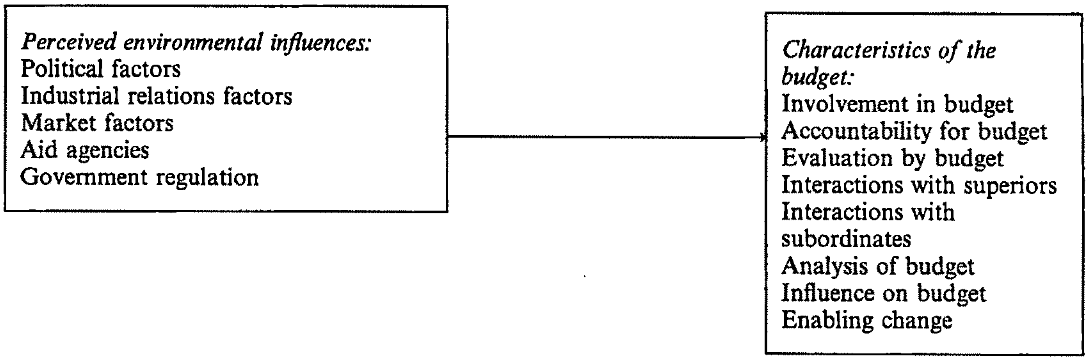
[3] The authors are suspicious of notions of scientific determinism implied in so many behavioural theories of accounting, hence their preference for research propositions rather than hypotheses. Statistical analysis is seen as a means of establishing patterns of order within complex data, but, given human agency, it is not assumed that these will necessarily persist. The aim of the research is to convince the reader, rather than 'prove' relationships between variables. The authors would argue that tests such as significance levels help establish structure in the data, and they add conviction to the story being told, but they are wary of using them to generalise and predict behaviour in this or other sites.

Figure 1
Framework for the study


Perceived environmental influences:
Political factors
Industrial relations factors
Market factors
Aid agencies
Government regulation
Characteristics of the budget:
Involvement in budget
Accountability for budget
Evaluation by budget
Interactions with superiors
Interactions with subordinates
Analysis of budget
Influence on budget
Enabling change

associated with lower perceived involvement with budget-related activities. However, in line with previous contingency research, there was the suggestion that when high competition involving costs was perceived, managers put a higher emphasis on budget-related activities. These observations formed the basis of the research propositions, and their connection to previous research is discussed briefly below.

The qualitative research indicated that the organisation had a formally rational and detailed budgetary control system, with considerable time and resources committed to it. Nevertheless, managers mainly disregarded it for managerial purposes because budgets were set centrally, it often bore little correspondence with operational realities, and major decisions often flowed from political intervention paying little regard to formal plans. The management accounting based on bureaucratic notions of control became decoupled from the management of operations. It was used more for external bargaining and legitimation rather than accountability, performance evaluation, managerial planning, decision-making and control. These observations mirror those of Berry et al. (1985) concerning the UK's National Coal Board which, like BJMC, was a statutory corporation subject to major political intervention. Other case study research on accounting in politicised environments has yielded similar results (Dirsmith and Jablonsky, 1979; Boland and Pondy, 1983, 1986; Covaleski and Dirsmith, 1986, 1988; Ansari and Euske, 1987).

Contingency research in accounting has tended not to study directly the impact of political environments on management accounting systems, though some studies suggest that effective organisations place less reliance on accounting performance measures under conditions of high environmental uncertainty (Govindarajan, 1984; Hirst, 1983; Brownell, 1985). This is usually explained in terms of cost accounting systems being unable to satisfactorily capture important dimensions of performance and information under such circumstances. However, in BJMC, political uncertainties were linked with a lack of managerial autonomy and thus an inability of managers to respond flexibly except through unofficial unsanctioned coping behaviour of a short-run nature. Bruns and Waterhouse (1975) found that low managerial autonomy (i.e., where decisions are made outside the organisation) was associated with low budget participation, low usage of budgets in performance evaluation, low analysis of variances and lower interaction with superiors. Similarly, Merchant (1981) found that centralisation accompanied by low budget emphasis was associated with decreased extrinsic motivation and lower perceptions of budget usefulness. These observations from contingency research resembled the insights from previous case study research (including the authors' own pilot study) and they form the basis of Proposition 1.

> **P1:** The more political factors are perceived to affect performance, the less important managers will perceive the following budget-related factors to be: their involvement in budgeting, their accountability for budgets, the use of budgets for managerial performance evaluation, their interactions with superiors and subordinates, their budget analyses, their influence on budget plans, and the contribution of budgets to managing change.[4]

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[4] In each proposition, each component of budget-related behaviour is postulated to move in the same direction in response to each independent environmental factor. It has been suggested that budget-related behaviour should therefore constitute only one dependent variable rather than several. This is a reasonable point but, given the exploratory nature of the re-

Trade unions and turbulent industrial relations had a major impact on management control in BJMC directly, and indirectly through their association with political intervention and patronage. Contemporary studies of the impact of trade unions and industrial militancy on managers' budget-related behaviour are relatively sparse (Berry et al., 1985 and Miller and O'Leary, 1994 being two major exceptions) despite a strand within accounting history claiming that cost accounting developments are attributable, in part, to issues of labour control (Hopper and Armstrong, 1991; Tinker and Neimark, 1988). Armstrong et al. (1996), in a major survey of large UK companies, found support for the conventional proposition that budgetary controls were a response to organisational size, diversity and problems of internal coordination. However, there was also strong evidence supporting the radical view that they were used more when labour forces had weak powers of resistance, giving managers greater freedom to act on accounting information. The suggestion of radical studies, and the results from the case study within BJMC, was that the effects of powerful trade unions and labour militancy would lead to managers placing less importance on budgetary control within their mills—hence the derivation of Proposition 2.

> P_2: The more managers perceive industrial relations factors to impact on their performance, the less importance they will attach to budget-related factors.

Budget emphasis in reaction to market uncertainty and competitiveness is complex (Ezzamel, 1990; Simons, 1990; Govindarajan, 1984). BJMC faced product innovation from substitutes outside the jute industry, and its markets were international and price competitive. Given high competition but a simple and unchanging jute production technology, strategies of price competitiveness with a strong emphasis on cost control through budgets might be expected (Gordon and Narayanan, 1984; Govindarajan, 1984; Khandwalla, 1972; Merchant, 1984; Miles and Snow, 1978; Simons, 1987, 1990). Some support for this came from the fieldwork. While managers in BJMC generally attached low importance to budget-related activities, for reasons explained above, they were aware of its potential value (within reconstituted managerial systems) in helping them meet market competition on price. Proposition 3 seeks to explore this by testing whether perceptions of high market competition were associated with managers attaching more importance to budget-related activities.

> P_3: The greater managers perceive the impact of external competition upon the performance of their mill, the more importance they will attach to budget-related activities.

During the pilot study, subjects often referred to the significance of aid agencies for the adoption and maintenance of formal rational systems of planning and control. Documentary evidence supported managerial options that the extensive budget systems within BJMC owed much to the pressure of aid agencies—often they were a condition for further funding. However, as control of the industry lay with politicians—often in cahoots with trade unionists—there was little prospect of such formal and apparently rational systems of management accounting being used by managers in a conventional fashion. Instead, they became transformed to give the *appearance* of responding to aid agencies' concerns for rational management while *in practice* being decoupled from operational management. These observations tally with another study in BJMC (Alam, 1990); observations of a series of attempts to introduce rational budgetary procedures into governmental organisations (Wildavsky, 1975); and, more generally, claims of institutional researchers such as Meyer and Rowan (1977) and DiMaggio and Powell (1983), who argue that in politicised environments rational procedures can become decoupled from management and transformed into rituals or means of securing legitimation from powerful external organisations. Proposition 4 sought to explore this argument further by establishing whether there was a connection between external aid agencies being perceived as influential, and managers' perceived importance of budget-related activities.

> P_4: The higher managers perceive the influence of aid agencies upon the performance of their mill, the more importance they will attach to budget-related activities.

Despite the frequent interventions into mill activities by politicians, the case study revealed that the mills had detailed and technically sound accounting systems embedded in a legal-rational bureaucracy responsible for industrial planning within a programme of national economic development. This operated within a centralised hierarchical framework of timetables, rules and regulations set by government ministries. Managers perceived procedures to be inflexible and rule-bound but, despite their lack of conviction that it aided operational planning and control, they executed budgeting to meet the stipulations of civil servants and ministers. Clearly, external factors bore on budget-related behaviour, but in a manner akin to early institutional research such as Selznick (1949) and Blau (1955), pointing out that bureau-

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search, we sought to analyse separately each component of budget-related behaviour.

cratic structures can be dysfunctional if rules become ends in themselves. In this instance, it was believed that a strong emphasis by state agencies on formal procedures was associated with rule-bound and ritualistic budgeting behaviour within mills and a subsequent disregard of budgets for internal management purposes. Proposition 5 tests this by examining whether high perceptions of external governmental bureaucracy were associated with managers placing a low emphasis on budget-related activities for managerial purposes.

> P_5: When government economic and legal regulations are deemed to have a major impact upon the performance of their mill, the less importance managers will place upon budget-related activities.

4. Research methods

The quantitative research sought to test the above propositions, involving independent variables somewhat neglected in contingency research, to test the validity and reliability of the conclusions drawn from the qualitative research stage. The case study research is reported in greater detail in Hoque and Hopper (1994), along with further important contextual information about the company.

The research commenced with a letter to BJMC's chief executive requesting research access. This resulted in BJMC's head office (HO) issuing a memo to its mills requesting their help and cooperation. The pilot study consisted of a series of semi-structured interviews and informal talks with key informants in HO and two mills about the nature of control and budgeting in BJMC. The pilot study was deliberately open-ended to enable the subsequent questionnaire to embrace issues that emerged from managers.

All 38 mills and regional offices within BJMC were solicited for participation in the questionnaire study in the second research stage. The pilot study revealed that only chiefs of mills, their accountants and regional officers had detailed knowledge about the organisation and control processes at the mill level. Consequently, the questionnaire was sent to 38 mill chiefs, 38 mill accountants and five regional managers, with a covering letter explaining the nature of the research project and indicating HO approval. Questionnaires[5] were mailed in January 1992 with a request for a reply by March 1992. They yielded 56 responses—a response rate of 69% of the population deemed relevant. The respondents consisted of 32 mill chiefs, 21 accountants and three regional managers. On average, the respondents were 40.2 years old, had worked in the jute industry for an average of 12 years, and had held their present positions for an average of 5.6 years. The managers were invariably graduates, professionally qualified and experienced.

Post-questionnaire interviews were conducted with 12 key personnel at HO and three mills near Dhaka (the capital of Bangladesh) to supplement and corroborate the questionnaire data. A variety of tactics to check the validity and reliability of responses to the questionnaire were employed, including triangulation across data sources and methods, getting feedback from participants in the study, and checking out rival explanations. A high degree of consistency was found.[6]

4.1. Environmental Factors: Independent Variables

Bangladesh has a long history of political instability (Ahmad, 1987; Hoque and Hopper, 1994)[7], which is linked to a turbulent industrial relations climate. Most national political parties have affiliated trade unions in the industrial sectors, and the intimacy between labour unions and politicians means that national politics have ramifications for the jute industry (Sobhan and Ahmad, 1980; Ahmad, 1987; Keeling, 1991; Matin, 1992; Hoque and Hopper, 1994). For example, jute workers (about 200,000) frequently participate in violent demonstrations, strikes and work stoppages called by the opposition political parties. Managers often complained that politicians directly intervened in BJMC's affairs in contravention of formally agreed plans, in order to ameliorate labour crises and to foster their political ends—thereby rendering budgets and plans meaningless. In order to measure managers' perceptions of political and industrial relations turbulence, the questionnaire asked each manager to indicate the impact each of the following six factors had on the success or failure of their mill: political instability, interventions by national politicians, trade union links with political parties, the actions of trade union officials, inter-trade union conflicts and strikes, work stoppages and worker violence.

BJMC was not immune from the effects of market forces. Market share and sales have declined nearly every year since nationalisation in 1972 because of competition from synthetic substitutes and other jute manufacturers. Many managers were acutely aware of the need for cost competitiveness and market flexibility, and while their satisfaction with budgetary processes tended to be low, they often believed that a more delegated and formally rational mode of budgeting would help BJMC meet foreign competition. Thus there was managerial frustration with external political interventions, which they believed prevented formal budgeting procedures achieving their commercial potential. The evidence from the case study, coroborated by official reports, led to three questions in the survey asking managers to assess the intensity of external competition on their mill, with respect to market share, synthetic substitutes and price.

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[5] A copy of the questionnaire is available on request from the authors.

[6] Managers may be prone to emphasise the faults of others and minimise their own failings—hence the importance of corroborative evidence and multiple methods. The fieldwork helped corroborate the managers' responses, which were consistent with previous research in BJMC (Ahmad, 1987; Alam, 1990) and reports for external agencies (World Bank, 1992).

[7] Although currently Bangladesh has an elected government, her political crises still remain. Strikes and demonstrations organised by opposition parties against the government, involving students and workers, and labour unrest in the industrial sector, are commonplace.

Budgeting within BJMC was embedded in a centrally-controlled system of formal national economic planning regulated by a series of detailed government directives and planning procedures. Mill managers reported that a series of government policies over matters such as exchange and interest rates, raw jute procurement, jute marketing, subsidies and labour-relations law seriously impeded their scope for effective planning and control. Detailed central government regulations extended to the conduct of budgeting at all levels, leading to excessive rule-bound behaviour and a perceived irrelevance of its function within management. Thus, while there was an ostensibly rational system of detailed budgetary control extending from national plans down to subsections of individual mills, managers saw it as little more than a ritualistic facade divorced from management. Instead, management control at mill level was achieved by a variety of informal and often ingenuous coping mechanisms, involving: unsanctioned payments; borrowing and internal transfers; unofficial agreements with labour leaders; selective indulgency patterns to labour; and unsanctioned swapping and borrowing of resources between mills (Hoque and Hopper, 1994). In order to assess the degree of central regulation over the mills, the survey included a question asking each manager how much impact they believed legal and governmental constraints had on the success or failure of their mill.

BJMC and its constituent mills have incurred huge losses over the past 20 years (Ahmed, 1978; Government of Bangladesh, 1985, 1990; Alam, 1990; Hoque and Hopper, 1994). Production and productivity has deteriorated and the industry has continually been beset with industrial relations problems and financial crises that have affected normal work practices and performance (United Nations, 1984; Government of Bangladesh, 1985; FAO, 1989; Hoque and Hopper, 1994). BJMC's propensity to deficit meant that the industry was dependent on external aid, as are nearly all the public sector programmes of Bangladesh (Government of Bangladesh, 1990; Keeling, 1991; Anwar, 1992). The jute industry is crucial to the Bangladeshi economy, but continuance of financial support from external agencies such as the World Bank was becoming increasingly threatened without major structural reforms such as privatisation. Thus it is not surprising that managerial perceptions of external factors affecting BJMC's budget-related behaviour extended beyond the state, Bangladeshi political institutions and markets to aid agencies. To secure financing of industrial deficits, the government had to satisfy aid agencies' accounting stipulations, including: providing statistical data on the execution of projects; the disbursement of funds; and the recovery of loans (Hoque and Hopper, 1994). Managers repeatedly referred to the effect of interventions by aid agencies on the government's policy towards the jute sector and its management procedures, including budgeting. For instance, the possible retrenchment of workers and staff, and the closures of mills, were seen as emanating from conditions attached to donors' reform packages and their attempts to cease subsidies (Keeling, 1991). In an attempt to measure the perceived effect of aid agencies, the survey asked each respondent how much impact the actions of external aid agencies had on the success or failure of their mill.

Thus, the managers participating in the questionnaire study were asked a total of 11 questions, described above, on a five-point Likert-type scale from one (very low) to five (very high), to measure their perceptions of the environmental factors on their mill's performance. All these questions were derived from the results of the pilot study described above.[8]

The descriptive statistics (means and standard deviations) of responses to each question on environmental factors are presented in Table 1.[9]

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[8] We have repeatedly been asked about the effect of culture on budgeting in this study. The reason for not incorporating culture within the set of independent variables is simple—it was not a major factor in the results from the pilot study (or subsequent research) unless one sees Bangladeshi politics and industrial relations as expressions of national culture. Some cultural issues, such as work patterns of rural workers, did have some significance, but these were relatively minor in the order of events. The authors believe that there is often a mistaken tendency by western commentators on non-western situations to immediately ascribe differences or surprises to culture. In some instances this may have validity but in this case it was not so—institutional factors were more important. We are confident in asserting this, as cultural issues were part of the scope of the interpretive methods used in the qualitative research stage. Moreover, our choice of independent variables are consistent with those emphasised in other research and official reports on this site (Ahmed, 1978; United Nations, 1984; World Bank, 1992), none of which emphasises culture as being a major issue.

[9] Tests of normality of the data (through histograms, skewness, kurtosis, normal plot and the studentised range test on each variable) indicated that the null hypothesis of non-normality of the distribution of the variables was rejected. A similar result was obtained for the dependent variables.

Table 1
Basic descriptive statistics of environmental (independent) variables

Variables	*Mean**	*Standard deviation*
Political instability	4.11	1.82
Interventions by national politicians	3.80	1.71
Linkage of labour unions with national political parties	4.09	1.13
Actions of elected trade union officials	4.23	1.50
Inter-trade union conflicts	3.89	1.65
Strikes, work stoppages and worker violence	4.03	1.65
Competition for market share	3.63	1.70
Competition with synthetic substitutes	4.09	1.62
Price competition	4.05	1.66
Actions of aid agencies	3.52	1.82
Legal and economic constraints imposed by government regulation	4.06	1.56

*Theoretical range, 1 - 5; 1, very low perceived environmental influence; 5, very high perceived environmental influence
N=56

The Cronbach alpha statistic (Cronbach, 1951) of 0.73 indicated that the 11 items were internally consistent and reliable. As expected, each variable was perceived as a high source of influence. The actions of elected trade union officials (mean 4.23); political instability (mean 4.11); the political linkage of labour unions with national political parties (mean 4.09); competition with synthetic substitutes (mean 4.09); price competition (4.05); strikes, work stoppages and worker violence (mean 4.03); inter-trade union conflicts (mean 3.89); and politicians' interference in day-to-day activities (mean 3.8) appeared to have particularly marked effects on operational matters.

Table 2 provides a correlation matrix between the 11 environmental (independent) variables.[10] Significant correlation coefficients between the environmental variables suggest that they are related and may constitute one or more factors (Bryman and Cramer, 1990; Nie et al., 1975; Williams et al., 1990). Consequently, a principal components analysis (PCA) of the 11 environmental variables was used to decide whether to combine them into overall factors. Table 3 presents the items that loaded most highly on each factor after orthogonal (varimax) rotation, the percentage of variance explained by each factor, and a factor title.

To facilitate the analysis, a single scale was constructed for each factor by taking the weighted average of respondents' scores for each item within the factor.[11] The Cronbach coefficient alpha was computed to measure internal consistency and reliability of each multi-item variable (see for similar uses, Merchant, 1981; Gordon and Narayanan, 1984; Chenhall and Morris, 1986; Ezzamel, 1990). In each case, the Cronbach alpha exceeded the commonly accepted minimum of 0.5, and the clusters made intuitive sense. The five summary measures were taken to represent managers' perceptions of the following factors on the performance of their mill: (1) the political situation in the country—its instability, interventions by politicians, and the joint actions of trades unions and political parties; (2) the effects of industrial relations on the organisation—through trade union officials, inter-trade union conflicts, and strikes and worker violence; (3) market factors—namely competition over market share, price, and with synthetic substitutes; (4) actions of external aid agencies; and (5) government constraints, i.e. rules and regulations. These factors were deemed to embrace the major sources of environmental pressure on BJMC.

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[10] All of the correlations reported in this paper are based on non-parametric tests. Principal components analysis assumes linear data, so non-parametric and parametric correlation matrices for the set of independent and dependent variables were computed and compared. In a minority of cases these yielded some differences with respect to the size and significance of 'r's'. Nevertheless, it was felt reasonable to use PCA to cluster variables in an exploratory study of this type. The clusters produced by the PCA made intuitive sense, and the Cronbach alphas for each cluster were sufficient to suggest they could be deemed to constitute a single theoretical construct. The use of the PCA results was confined to summarising the analysis of variables to obtain a parsimonious result.

[11] This study reports only the results based on weighted average scores from the PCA for both the independent and dependent variables consistent with Haka (1987) and Ezzamel (1990). However, unweighted average scores were also used to test the research propositions. The two sets of results were very similar throughout.

Table 2
Correlation matrix for environmental (independent) variables

	Intercorrelations										
Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1. Political instability	1.00	0.28*	0.32**	0.31**	0.33**	0.56***	0.27**	0.22*	0.27*	−0.12	0.27*
2. Interventions by national politicians		1.00	0.35**	0.35**	0.26*	0.29*	−0.04	0.24*	0.04	−0.16	0.18
3. Linkage of labour unions with national political parties			1.00	0.25*	0.39**	0.05	0.15	0.16	0.09	0.18	0.07
4. Actions of elected trade union officials				1.00	0.43***	0.41	0.05	0.28*	0.27*	0.12	0.17
5. Inter-trade union conflicts					1.00	0.36**	0.31**	0.16	0.13	0.15	0.08
6. Strikes, work stoppages and worker violence						1.00	−0.08	−0.16	0.09	0.30**	0.40**
7. Competition for market share							1.00	0.50**	0.53***	0.23*	0.07
8. Competition with synthetic substitutes								1.00	0.37**	0.04	0.10
9. Price competition									1.00	0.33**	0.08
10. Actions and aid agencies										1.00	0.30**
11. Legal and economic constraints imposed by government regulation											1.00

***$p<0.001$; **$p<0.01$; *$p<0.05$ (one-tailed)
N=56

Table 3
Reducton of environmental (independent) variables: factor matrix using PCA*

No.	*Factor description of variables*	*Factor loadings (>0.40)*	*Percentage of variance*	*Cumulative percentage*	*Cronbach alpha*
1.	**Political factors**				
	Political instability	0.77	23.5	23.5	0.54
	Interventions by national politicians	0.71			
	Linkage of labour unions with national political parties	0.45			
2.	**Industrial relations factors**				
	Actions of elected trade union officials	0.73	15.3	38.8	0.55
	Inter-trade union conflicts	0.66			
	Strikes, work stoppages and worker violence	0.65			
3.	**Market factors**				
	Competition for market share	0.77	10.5	49.3	0.71
	Competition with synthetic substitutes	0.66			
	Price competition	0.65			
4.	**Actions of aid agencies**	0.92	10.0	59.3	n/a
5.	**Legal and economic constraints imposed by government regulation**	0.96	9.5	68.8	n/a

*Varimax orthogonal rotation (N = 56)

4.2. Budgetary Controls: Dependent Variables

Budgeting in this study refers to those managerial activities, actions, attitudes and interactions associated with budgets (Williams et al., 1990). As reported above, the pilot study revealed a high level of dissatisfaction amongst managers with budgeting in BJMC on matters such as participation, its accuracy, and its relevance for accountability, performance evaluation and decision-making. It was decided to measure managers' perceptions of budget-related activities on the battery of 44 questions developed by Swieringa and Moncur (1975) and subsequently used by Bruns and Waterhouse (1975), Merchant (1981, 1984), Ezzamel (1990) and Williams et al. (1990). This instrument effectively covered items that managers had revealed to be matters of concern during the pilot study, and there were advantages in using a well-tested and robust instrument widely used in other studies.

These original items, suitably modified[12], formed the basis of questions on managers' perceptions of budgeting. Respondents were asked, on a five-point scale ranging from one (very little extent) to five (very large extent), to indicate their involvement in the 44 budget-related activities. Summary descriptive results from the questionnaire appertaining to these 44 budget-related activities revealed low mean scores (from 1.14 to 2.59), indicating low degrees of involvement in budgeting. Table 4 gives details of the basic statistics for the responses to the 23 questions subsequently used in the statistical analysis.[13]

Generally, the results in Table 4 indicate the mill managers' perceptions of their lowly involvement in the budgetary process and their low influence on its eventual formulation, i.e. the participation of mill management was low. Relatedly, managers' interaction with their superiors and subordinates on budget matters was very low. Respondents appeared to make little use of the budget in their day-to-day management of activities—they conducted little analysis of variances nor did they rate budgets highly as a means of facilitating change. A Mann-Whitney U test (Siegel and Castallen, 1988) was performed to examine whether there were significant differences between the distributions of accountants' and non-accountants' responses. The test results revealed no significant differences be-

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[12] In a pre-test of the Swieringa and Moncur questionnaire, managers were encouraged to comment on items that were unclear and irrelevant to them. While most of the participating managers perceived the 44 budget-related activities as relevant and meaningful to their organisational circumstances, some questions needed to be reworded in the light of their comments.

[13] Descriptive data on questions not used are omitted for reasons of space and ease of reading.

Table 4
Basic descriptive statistics for budgeting (dependent) variables used in empirical analysis

	Description of variables	*Mean*	*Standard deviation*
1.	I express my opinion on budget matters within my organisation	1.82	1.38
2.	I offer suggestions for the improvement of budget systems.	1.96	1.56
3.	The budget system is changed in accordance with my suggestion	1.36	0.77
4.	I work with other unit heads in preparing the budget for my unit.	1.64	1.23
5.	I discuss budget items with my subordinates when problems occur.	2.59	1.66
6.	I am required to submit an explanation in writing about causes of budget variances.	1.21	0.56
7.	I am required to report actions I take to correct causes of budget variances.	1.43	0.95
8.	I am required to prepare reports comparing actual results with budgets.	1.14	0.35
9.	I am required to trace the cause of budget variance to groups or individuals within my department.	1.25	0.44
10.	I am evaluated on my ability to meet the budget for my unit.	1.14	0.35
11.	My superior expresses dissatisfaction to me about results in my department when the budget has not been met.	2.36	0.40
12.	My superior mentions budgets when talking to me about my efficiency as a manager.	1.21	0.41
13.	I evaluate my subordinate by means of the budget.	1.93	1.36
14.	I work with my superior in preparing the budget for my unit.	1.46	1.04
15.	I am consulted by my superiors about special factors I would like to have included in the budget.	2.09	1.59
16.	I work with my subordinates in preparing the budget for my unit.	2.20	1.69
17.	I investigate favourable as well as unfavourable budget variances for my department.	1.98	1.37
18.	Preparing the budget for my unit requires my attention to a great number of details.	1.66	1.24
19.	I personally investigate budget variances in my department.	1.27	0.45
20.	The budget is finalised only when I am satisfied with it.	1.29	0.71
21.	New budgets include changes I have suggested.	1.23	0.57
22.	The budget enables me to be more flexible.	1.79	1.40
23.	The budget enables me to be a better manager.	1.21	0.78

†For reasons of space, only questions that were incorporated into the analysis following reduction of variables by principal components analysis (factor analysis) are included here.

Note: Scale, 1-5: 1, very low degrees of involvement in the budget-related activities; 5, very high degrees of involvement in the budget-related activities.
N=56

tween the two groups. This was not surprising, given that almost all mill staff (accountants and non-accountants) felt overwhelmed by external political pressures and expressed grievances regarding their budgets—especially the lack of participation, the failure to incorporate motivational factors and their irrelevance to day-to-day decisions. The lack of significant differences between the two groups are consistent with the qualitative data reported elsewhere (Hoque and Hopper, 1994). Accounting controls, along with other formal controls, played little direct role in mill management, which tended to be restricted to short-run planning, negotiations with trade union officials, and seeking unofficial and unsanctioned deals to keep the organisation financially afloat and in production (Hoque and Hopper, 1994).

The correlation coefficients of most variables (not shown) were significantly positively correlated, as expected, which suggested that they could constitute one or more factors. A PCA was performed to assess the degree to which items might be tapping the same concept, and to make sense of the complexity of individual budget-related behaviour by reducing it to a smaller number of factors.[14] This yielded eight factors with eigenvalues

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[14] The reliability of the factors that emerge from a factor analysis is determined by the size of the sample, but there is no consensus on what this should be. There tends to be agreement that there should be more subjects than variables, though some argue that factor analysis can be carried out on samples smaller than the number of variables to describe the relations between variables (Bryman and Cramer, 1990). In this study, the number of subjects exceeded the variables (56 subjects and 44 var-

Table 5
Reduction of budget-related (dependent) variables: factor matrix using PCA*

Factor	*Description of variables*	*Factor loadings (>0.40)*	*Percentage of variance*	*Cumulative percentage*	*Cronbach alpha*
1.	**Involvement in budget**				
	I express my opinion on budget matters within my organisation.	0.74	26.5	26.5	0.78
	I offer suggestions for the improvement of budget systems.	0.73			
	The budget system is changed in accordance with my suggestions.	0.68			
	I work with other unit heads in preparing the budget for my unit	0.64			
	I discuss budget items with my subordinates when problems occur.	0.57			
2.	**Accountability for budget**				
	I am required to submit an explanation in writing about causes of budget variances.	0.83	9.2	35.7	0.78
	I am required to report actions I take to correct causes of budget variances.	0.78			
	I am required to prepare reports comparing actual results with budgets.	0.72			
	I am required to trace the cause of budget variance to groups or individuals within my department.	0.60			
3.	**Evaluation by budget**				
	I am evaluated on my ability to meet the budget for my unit.	0.90	8.0	43.7	0.64
	My superior expresses dissatisfaction to me about results in my department when the budget has not been met.	0.85			
	My superior mentions budgets when talking to me about my efficiency as a manager.	0.70			
	I evaluate my subordinate by means of the budget.	0.58			
4.	**Interactions with superiors**				
	I work with my superior in preparing the budget for my unit.	0.76	7.7	51.3	0.54
	I am consulted by my superiors about special factors I would like to have included in the budget.	0.46			
5.	**Interactions with subordinates**				
	I work with my subordinates in preparing the budget for my unit.	0.85	6.5	57.9	n/a
6.	**Analysis of budget**				
	I investigate favourable as well as unfavourable budget variances for my department.	0.67	4.9	62.8	0.76
	Preparing the budget for my unit requires my attention to a great number of details.	0.66			
	I personally investigate budget variances in my department.	0.56			
7.	**Influence on budget**				
	The budget is finalised only when I am satisfied with it.	0.79	4.5	67.3	0.58
	New budgets include changes I have suggested.	0.70			
8.	**Enabling change**				
	The budget enables me to be more flexible.	0.82	3.9	71.2	0.46
	The budget enables me to be a better manager.	0.51			

*Varimax orthogonal rotation (N = 56)

Table 6
Intercorrelations (Spearman Rank-order) between budgeting (dependent) variables used in empirical analysis

	Intercorrelations							
Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Involvement in budget	1.00	0.22**	0.34***	0.50****	0.10	0.31**	0.23*	0.03
2. Accountability for budget		1.00	0.28**	0.45****	0.11	0.10	0.11	0.20*
3. Evaluation by budget			1.00	0.28**	0.33***	0.15	0.15	0.09
4. Interactions with superiors				1.00	0.14	0.35***	0.23*	0.05
5. Interactions with subordinates					1.00	0.18	0.11	0.20*
6. Analysis of budget						1.00	0.11	0.21*
7. Influence on budget							1.00	0.34***

****$p<0.001$; ***$p<0.01$; **$p<0.05$; *$p<0.10$ (one-tailed).
$N=56$

greater than 1.0. In order to increase the interpretability of these factors (Bruns and Waterhouse, 1975; Merchant, 1981; Harrison, 1993), the scores of each were rotated using the orthogonal varimax criteria (Kaiser, 1958). The results are shown in Table 5.

The clusters made intuitive sense and they were interpreted as representing:

1. *Involvement in budget*—managers' perceptions of their involvement in the budgeting process.
2. *Accountability for budget*—the perceived accountability of managers for budget results, especially to senior management.
3. *Evaluation by budget*—the extent managers perceived budgets as being used for managerial performance evaluation.
4. *Interactions with superiors*—managers' perceived interaction with their superiors within the budgetary process.
5. *Interactions with subordinates*—managers' perceived interaction with subordinates during budget preparation.
6. *Analysis of budget*—the extent managers perceived they used budgets within their own area of responsibility.
7. *Influence on budget*—managers' perceived influence over the final formulation of the budget.
8. *Enabling change*—the extent managers perceived that budgeting promoted innovative and flexible management within their sphere of activities.

The Cronbach alpha statistics for each factor involving aggregation were well above the lower limits of normal acceptability, except for factor 8 (enabling change), which at 0.46 was marginally below (Nunnally, 1967; Merchant, 1981; Gordon and Narayanan, 1984). However, despite its narrow failure to meet the acceptability test, it was decided to retain this variable for preliminary experimentation.

Table 6 presents the Spearman correlation coefficients between the weighted budgeting variables derived through PCA. Most variables were positively and significantly correlated, as expected. These results are consistent with similar prior research (e.g., Bruns and Waterhouse, 1975; Merchant, 1981, 1984; Ezzamel, 1990; Williams et al., 1990).

5. Results

Spearman rank-order correlation coefficients testing the propositions (for a similar use see Merchant, 1981; Scapens and Sale, 1985) are reported in Table 7. The analysis is based on the correlation of the five environmental variables with the eight budget-related variables derived from the PCA.[15]

Table 7 gives strong support to Proposition 1. Political climate is significantly associated, as postulated, with all the budget-related variables, except interaction with subordinates and involvement in budgeting. Where managers perceive the effects of political factors to be high, they perceived low use of budgets in performance evaluation, low budget accountability, low managerial influence over budgets, low usage of budgets for instituting change, and low interaction with superiors on budget matters. The results provide sup-

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iables). Increasing the sample size would have been difficult given that the total population was only 81, with a response rate of 69%.

[15] Further confirmation of this analysis was made by correlating each constituent environmental variable on the eight budget-related variables. These results are available from the first named author on request.

Table 7
Spearman Rank-order correlations between environmental (independent) and budgeting (dependent) factors

	Environmental factors				
Budgeting factors	*Political*	*Industrial relations*	*Market*	*Aid agencies*	*Government regulations*
Involvement in budget	−0.18	−0.51***	0.57****	−0.07	−0.30***
Accountability for budget	−0.25**	−0.14	0.44****	−0.01	−0.38***
Evaluation by budget	−0.24**	−0.27**	0.35***	−0.01	−0.29**
Interactions with superiors	−0.19*	−0.27**	0.57****	−0.08	0.11
Interactions with subordinates	−0.10	−0.21*	0.20*	0.04	0.03
Analysis of budget	−0.34***	−0.22**	0.35***	−0.21*	−0.22**
Influence of budget	−0.33***	−0.11	0.37***	−0.05	−0.15
Enabling change	−0.38***	0.03	0.41****	−0.17	−0.19

****$p<0.001$; ***$p<0.01$; **$p<0.05$; *$p<0.10$ (one-tailed)
$N=56$

port for the conclusions of the case study research claiming that short-run, arbitrary interventions associated with the unstable political situation, and the coalition of trade union leaders with politicians, led managers to have a sceptical and diminished perception of the role of budgets for conventional managerial purposes. The reason for the lack of association between political factors and interaction with subordinates is not clear, though it is possible to surmise that managers attribute the contagion affecting budgeting to external uncontrollable forces, leaving organisational relationships unaffected.

Industrial relations factors were significantly correlated with several facets of managers' budget-related behaviour as postulated. When the impact of industrial relations on operations was high, it was associated with managers' low involvement in budgeting and the low use of budgets for performance evaluation and, to a lesser degree, low managerial interaction with subordinates and superiors, and low managerial analyses of budgets. The results are similar, but not identical, to those for political factors. Whereas political factors had relatively little effect on budget involvement, the effect of industrial relations was marked, especially from strikes and worker violence. On the other hand, unlike the political factors, industrial relations did not have a marked effect on managers' perceptions of budgeting as a vehicle for change or their influence on budgets, or their accountability for them. The suggestion is that industrial relations conflicts were not seen to impinge on some of the formal budgeting processes, but rather produced a distancing by managers in terms of interaction and use of budgeting. However, such conclusions should be treated as highly tentative.[16] Generally, as was confirmed in the field study, political and industrial relations factors tended to produce similar effects, namely a diminished managerial perception of the value of budget-related activities.

The correlations between market competitiveness factors and budgeting provide strong support for Proposition 3—the overall index of market competitiveness is strongly positively correlated with all but one of the budget-related factors, as postulated. Perceptions of overall competition affecting mill performance is strongly associated with greater involvement of managers in budgeting, greater perceptions of their influence within budgeting, greater use of budgets for performance evaluation and accountability, higher managerial analyses of budgets, greater interaction with superiors, and a greater belief in the role budgets can play in promoting change. The strong and consistent relationships between market competition and budget-related factors suggest that managers who perceive themselves to be in highly competitive situations tend to positively emphasise budget-related activities.

The strength and consistency of these results supported conclusions from the case study. The initial analysis of descriptive results had indicated that managers had a low evaluation of budget-related activities as practised because of a strong belief that political and industrial relations factors rendered budgetary control meaningless in terms of operational management. Nevertheless, many managers maintained that if the influence of these extraneous factors on operational matters could be significantly reduced, then budgeting had the potential to manage the organisation commercially to meet the financial damage being wrought by competition. The quantitative results do not conflict with this analysis, but they do reveal that even under prevailing conditions, managers who perceived strong competition perceived budget-related activities as important. Unfortunately, whether this was related to performance or managerial conditions at different sites, or merely attitudinal factors, cannot be determined, as the initial research design did not incorporate data on these factors.

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[16] For example, the correlations between industrial relations factors and budget accountability and budget influence produced an association in the direction of the proposition (−0.29, $p < 0.05$ and −0.22, $p < 0.10$ respectively) when unweighted factors were used.

The associations between budgeting variables and the remaining contingent factors—'aid agencies' and 'government regulations'—were weaker than those for the other environmental variables. Proposition 4 had surmised a positive association between the impact of external aid agencies and an emphasis on budget-related activities. However, this was the most difficult proposition to formulate, for while aid agencies might be major influences on the adoption of formal rational controls, once instituted, the systems might exist only to satisfy such external demands and slip into a symbolic legitimatory role. As can be seen in Table 7, there was no evidence to support Proposition 4. Indeed, there was no association between the influence of aid agencies on budget-related activities at all. In retrospect, the questionnaire data on this point may have been too blunt an instrument for studying a complex and contradictory process.

The data in Table 7 does, however, support the relationships between government regulations and budgeting variables as expressed in Proposition 5. High governmental regulation is strongly correlated with low budget accountability, the low use of budgets for managerial performance evaluation, low managerial involvement in the budget process, and low managerial analyses of budgets. The evidence suggests that high government intervention in firms via detailed economic policies and regulations is associated with a diminished role for budgeting within unit level management. This gives modest indirect support for the case study conclusion that managers executed budgeting in a ritualistic fashion to meet external demands by governmental bodies. However, managers did not appear to attribute their perceived low influence in budgeting to the intervention of civil servants, but rather to politicians often acting in tandem with trade unions.

6. Discussion

This paper reports significant associations between managers' budget-related behaviour and environmental factors. It is pertinent to contingency theory in several respects. By generating variables from the field, it has drawn attention to the importance of previously neglected institutional factors, especially political and industrial relations ones, and the case study observations enabled causality and effects to be attributed with greater confidence. The interpretive research not only generated and verified new important variables, but it also enabled potentially important (and fashionable) ones such as culture to be screened out on the grounds of irrelevance.

The research results' suggestion that political and industrial relations uncertainties are negatively associated with managers using budgetary control for conventional purposes tallies with the effects of low managerial autonomy noted in previous contingency studies. Managers placed a strong emphasis on budgetary control for conventional managerial purposes when they perceived their mills to be in highly competitive circumstances. This latter result is also consistent with previous contingency research on the effect of competition on budgetary practices. In summary, when managers perceived the intervention of politicians, trade union leaders and government officials as great, the less importance they placed on budgeting; perceptions of high competition had the opposite effect.

The fieldwork and quantitative results suggests that it is an error to conflate political and industrial relations factors into a single measure of environmental uncertainty along with competitiveness and technological factors, as their effects can be very different.[17] For example, task uncertainty can render conventional accounting controls that primarily programme and monitor behaviour dysfunctional. Instead, the accounting system may play other roles associated with creativity, environmental adaptation and learning, with control ensuing from mechanisms other than accounting (Earl and Hopwood, 1980; Macintosh, 1994). Although the accounting role changes in this scenario, it still assumes purposive and economically rational managerial action. However, in BJMC, the politics and industrial relations rendered conventional budget systems dysfunctional to management, much to their chagrin, but changing them was not feasible as managers were powerless, and those with power—namely the politicians—did not operate in a commercial environment.

Institutional theorists (Meyer and Rowan, 1977; DiMaggio and Powell, 1983), in common with contingency theorists, argue that organisational practices are shaped by environments: the latter become an isomorphism of their institutional environment. However, unlike contingency theorists, they demonstrate how and why bureaucratically rational systems of control become transformed when political factors predominate. In such instances, budgeting is often decoupled from the everyday practices of management and instead becomes a ritual to meet governmental demands and a means of securing external legitimation. The case study provided strong evidence that this occurred within BJMC.[18] Management strategies to cope were essentially political and ad hoc, and included securing trade union cooperation through bribes, selective granting of favours, indulgency patterns for labour, and securing cash for immediate needs through unauthorised means.

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[17] This conclusion is similar to that of Alam (1990, 1995), who was also conducting similar research within BJMC just prior to our own, with similar results.

In summary, the managers were caught between two conflicting sets of demands—political and market-based—that called for quite different responses, namely micro-political and commercially rational respectively. This poses significant research problems. The complexities and dynamics of political behaviour may not be best captured by survey research in a contingency theory vein. Qualitative methods have many advantages in this respect, as was found in this study. However, the benefits of triangulation flow both ways. As reported earlier, case study research has limitations with respect to the generalisation, replication and validation of its results. In the BJMC research, the survey results supported those from the case study regarding the effects of politics, industrial relations and government departments on budgeting, but it cast doubts on the believed effects of aid agencies. Thus the survey, built on intensive case study observations rather than prior research, enabled the researchers to build and validate a more holistic picture of the organisation. In so doing, it provided new insights, especially on the strong relationship of perceived competition with positive perceptions of budgeting. Nevertheless, while this triangulation was productive in many respects, lessons were learned that may be of value to future researchers.

The survey research was initially directed at validating and generalising fieldwork results rather than testing contingency theories per se. The research orientation was rooted in the interpretive tradition of understanding events from the perspective of actors rather than seeking prescription or prediction. In addition, it was believed that grounded research is more likely to reveal important and surprising results than more 'hands off' survey methods. In retrospect, while not wishing to deny the validity of such beliefs, the researchers found that the domination of interpretive concerns over those of contingency theory limited the effectiveness of the triangulation research. For example, in this study, the independent variables were drawn from fieldwork rather than previous contingency research. This had major advantages in throwing up new variables, but the subsequent exclusion in the survey of common contingency variables not found during fieldwork, such as task uncertainty, culture and size, prohibited the researchers' scope for comparing their results with previous contingency research. The exclusion of key contingency variables made it more difficult to systematically demonstrate their presumed irrelevance. As the quantitative results subsequently demonstrated a limited capacity to surprise, the omission of contingency variables solely on case study evidence is difficult to justify: research surprises are not exclusive to case study research.

Lessons were learned about the treatment of effectiveness and power in triangulation studies. Interpretive theory tends to eschew the direct consideration of prescription in the (questionable) belief that is not normative. Instead, the research aims to understand behaviour from the perspective of the actors concerned, with an emphasis on processes and beliefs.[19] This study adopted such an orientation, and the case results provided rich detail on the micro-processes of managers' coping within their constrained powers. In addition, it helped identify the external sources of power that gripped the organisation's behaviour. These provided the basis for testing the association of environmental factors with budget behaviour in a contingency study vein.

However, the de-emphasis of systematic measurement of effectiveness generally, and with respect to different interests, was in retrospect mistaken. For example, while the case study revealed that managers strongly believed that budgeting accompanied by greater managerial autonomy could help them meet competition, the survey results suggested that managers who saw themselves in very competitive situations perceived budget-related activities more positively, despite their current lack of managerial autonomy. With hindsight, it would have been interesting to explore these results further by, say, relating self-appraisal measures of individual managers' performance and/or indices of their mills' performance to managers' perceptions of environmental variables and budget-related behaviour.

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[18] Alam (1995), who was also researching BJMC at a similar time, reaches similar conclusions.

[19] Effectiveness is a highly disputable concept, which ultimately resides in individual values. Nevertheless, it is crucial for interpreting research results in practical terms—and this study is no exception. 'Scientific' accounting research, especially positive theory, has quite rightly been criticised by qualitative researchers amongst others for attempting to privilege itself theoretically by making a fallacious distinction between normative and descriptive research. However, qualitative research that over-emphasises its descriptive basis and disclaims its prescriptive aspect can unwittingly fall into the same trap. There is a greater need for qualitative research to address the issue of effectiveness in its research, not only from the perspective of subjects, but also other affected constituencies.

In short, the lesson to future researchers attempting such triangulation is to test a fuller model that includes effectiveness measures and variables derived from contingency theory as well as from the field. Even if variables appear irrelevant during fieldwork, they may subsequently be vital to obtaining the maximum theoretical and empirical advantage from triangulation.

However, conceptualising effectiveness in this case is not straightforward: triangulation confined to grounded, contingency and institutional behaviour theories may neglect important socio-economic factors involved with power. If the criterion of effectiveness is commercial, as tends to be the case in contingency studies, then BJMC must be deemed a major failure. It has consistently made losses over 20 years, failed to meet targets, lost market share, suffered declining productivity and, at the time of the research, it was in financial crisis and facing closure and/or privatisation. Thus the case could be seen as an exemplar of ineffective business practice. On the other hand, viewed from a political and socio-economic perspective, the way external parties exercised power over BJMC may make sense to the actors concerned.

Bangladesh is an exceedingly poor country with turbulent politics, and the jute industry trade unions play a central role in this. To manage the industry only by commercial means might merely exacerbate social and political instability and hence the economic well-being of the country, as well as threatening the survival of dominant politicians. Despite being in perpetual financial crisis, the industry has survived and it has been a major source of relatively well-paid employment for those fortunate enough to secure a job in the industry. One could argue that past practices enabled governments and state officials to pass off apparently rational practices to external funding bodies unwilling to pull the plug on an industry central to the economic development of one of the poorest economies in the world, while simultaneously permitting governments to respond flexibly to domestic political pressures.

This raises a series of issues about how the exercise of accounting is connected to differential powers of constituencies, the relation of market capitalism to economic development, and the role of the state, none of which is well addressed empirically or theoretically in either the contingency or interpretive literatures. Not surprisingly, given that this piece of research was rooted in these literatures, it suffers from similar deficiencies. The interpretive case study research provided rich descriptive data indicating the existence and importance of socio-economic factors, but its underlying theory provided little theoretical insight into extra-organisational factors. Contingency theory enabled such relations to be modelled and tested, but it cannot transcend the descriptive: like grounded theory, it did not provide theoretical explanations of power or relevant research on socio-economic institutions, especially in developing countries. Contingency and interpretive approaches both served useful purposes, but the researchers learned that broader socio-political factors—drawing from the political economy of development—must be incorporated in the initial research stages if the role of accounting research in this area is to progress (see Wickramasinghe, 1996, for a full review of the relevant literatures and an illustration of how this can be executed empirically).

Finally, we would like to return to the issues raised at the beginning of the paper regarding accounting in developing countries and statutory corporations. The data in this study come from a single corporation—consequently any generalisation of its results to public sector organisations in Bangladesh or beyond cannot be made without considerable caution. Nevertheless, it would be wrong to assume that research on statutory corporations in developing countries is not pertinent to advanced economies and vice versa. As explained earlier, statutory corporations commonly exist in western countries and were often the models for developing countries. Western statutory corporations have suffered similar problems in a less acute form to those described in BJMC, for example political intervention, disappointing economic performance, poor industrial relations and ineffective accounting.

Comparative research offers a means of unpicking difficult issues with a view to formulating better practice. For example, Alam (1995) compared budgeting practices in BJMC to those in another Bangladeshi state corporation, the Sugar and Food Industries Corporation, which was smaller, less significant politically and profitable. Unlike BJMC, the Sugar Corporation faced a more certain environment and could buffer its technical core from its institutional environment, and its managers perceived budgets to be an important management tool. Such results suggest that it is dangerous to assume that statutory corporations are bound to fail because of political factors or that failing situations are not recoverable. This is especially important given the current enthusiasm for privatisation as a panacea, which is often based on little analysis or research. Again, these are not issues and debates exclusive to developing countries: the scale and international scope of public sector restructuring demands more comparative research generally, and especially in developing countries.

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The Impact of Segment Definition on the Accuracy of Analysts' Earnings Forecasts

Simon Hussain*

Abstract—This study investigates forecast error determinants for a set of forecasts of annual corporate earnings, generated by UK analysts 22 months prior to the announcement dates. This study is particularly concerned with the impact of segmental data on forecast errors; the hypothesis under test is whether finer segment definitions provide market participants with improved insight. If segments are too broad or vague (e.g. *rest of the world*) it is unlikely that data for such segments will provide analysts with any additional information regarding the current corporate position or future prospects. The results of this study provide evidence of predictive gains to both line-of-business data and geographic data, although these gains appear to be concentrated within a sub-sample of firms for which analysts appear to have specific difficulty in forecasting earnings, i.e. those experiencing negative changes in earnings. The results also indicate that forecast errors are: negatively related to firm size; positively related to the magnitude of the change in earnings which the analyst must predict; and not significantly affected by the number of reported segments.

1. Introduction

One of the main rationales for segmental disclosure is that it provides investors with improved predictive ability regarding corporate prospects (e.g. earnings). The UK accounting standard SSAP 25, *Segmental Reporting* (ASC, 1990) identifies the two main bases for segmental analysis as (i) the class of business, and (ii) the geographical areas in which a company is engaged. SSAP 25 provides extensive guidelines for segment identification; it lists a wide range of factors that may be taken into account when determining reportable segments. However, the list is so diverse that many differing approaches are consistent with the SSAP 25 guidelines. In addition, there is little to prevent the inappropriate amalgamation of lines-of-business or geographic regions. The same criticism also applies to the US accounting standard SFAS 14 (FASB, 1976), whose guidelines for segment identification are very similar to those given in SSAP 25. Both standards allow companies to define segments in almost any manner they find suitable.

The result is a wide range of differing reporting practices across UK companies, some of which are likely to be of limited use for investors' purposes. Too broad or vague segments (e.g. *rest of the world* or *other activities*) provide users with little additional insight. The problem of poorly identified segments has long been recognised as a major issue in segmental reporting (see Emmanuel and Gray, 1977: 37). Surveys of UK analysts' forecasting procedures (Arnold and Moizer, 1984; Day, 1986) show that many use a break-down and build-up approach to forecasting earnings. Segmental data is used in conjunction with specialist industrial and economic forecasts, to predict future consolidated earnings. However, data for industrial segments, for example, can only be utilised effectively if the segments correspond to recognised industry sectors for which analysts can obtain past data and forecasts. The aim of this study is to investigate the impact of segment definition on the accuracy of analysts' earnings forecasts.

2. Previous research

One approach to analysing predictive gains to segmental data is to generate forecasts of consolidated earnings using a set of forecasting models; some of the models utilise segment data, while others utilise consolidated data only. This form of analysis concentrates on either line-of-business data (Kinney, 1971; Collins, 1976; Emmanuel and Pick, 1980) or geographic data (Roberts, 1989; Balakrishnan, Harris and Sen, 1990), but not both. These studies indicate that segmental sales and profit data allow the construction of superior fore-

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casts. However, there is no evidence of significant additional predictive gains where both segment sales and segment profit data are used in the same model.

Other studies have investigated the impact of segmental reporting on analysts' earnings forecasts. One reason for preferring analysts' forecasts to model-based forecasts is the evidence of greater accuracy for analysts. Evidence indicating analysts' superiority is provided by Brown and Rozeff (1978), Collins and Hopwood (1980), Fried and Givoly (1982), Cooper and Taylor (1983), Cooper (1984), Bhaskar and Morris (1984), O'Brien (1988) and Patz (1989). Rational investors will use the most accurate source of forecasts to form their expectations, and evidence that analysts' forecasts are a superior proxy for market expectations of earnings is provided by Fried and Givoly (1982) and Brown, Griffin, Hagerman and Zmijewski (1987). A major rationale for segmental disclosure is that it may improve analysts' and investors' predictive ability, so leading to more informed investment decisions and, therefore, more efficient allocation of capital resources (see Baldwin 1984: 376). Only those forecasts that are used by investors have implications for the allocation of capital resources. An important point to note is that if analysts use a wider information set than statistical models, as appears to be the case, it cannot be concluded that the impact of segment information identified using model forecasts will necessarily be the same as for analysts' forecasts. This is another reason for using analysts' forecasts instead of model forecasts.

Studies by Baldwin (1984) and Swaminathan (1991) investigate the impact of the Securities and Exchange Commission's 1970 line-of-business reporting requirements on analysts' earnings forecasts. Baldwin finds that the introduction of the SEC's reporting requirements leads to a reduction in forecast errors, and that these predictive gains increase with the forecast horizon. This finding is consistent with the general view that segmental data is used by analysts for the construction of longer-term earnings forecasts, i.e. 12–24 months ahead (see Emmanuel and Garrod, 1987). The study by Swaminathan finds that the spread of earnings forecasts, across different analysts, is reduced in the presence of segmental data, indicating an increased degree of consensus. Studies by Barefield and Comiskey (1975a) and Emmanuel, Garrod and Frost (1989) attempt to measure the impact of different amounts of segment data on analysts' forecast errors. Barefield and Comiskey measure the amount of line-of-business segmental data using a scoring system devised by Kochanek (1974); they find a negative association between forecast errors and the amount of segmental data measured by the segmental reporting score. Emmanuel, Garrod and Frost present 15 analysts with financial data for a real (but unnamed) company and ask them to predict earnings using this data. By increasing the amount of segmental data in a step-by-step manner, they find that the greatest improvements to forecast accuracy arise from the provision of segment sales and profit data; other data (e.g. assets) has little impact.

There has been no empirical study of the impact of segment definition on analysts' forecasts. This is an unusual omission, given the importance of the topic in early segmental studies (Mautz, 1968; Backer and McFarland, 1968) and the extensive guidelines for segment identification provided in accounting standards like SSAP 25. The issue of segment definition has arisen only in studies that make suggestions for segment definitions, based on some rationale (Solomons, 1968; Emmanuel and Gray, 1978; Hussain and Skerratt, 1992); and studies which survey preparers' views (Emmanuel and Garrod, 1987; Edwards, 1995) and current reporting practices (Rennie and Emmanuel, 1992; Hussain, 1996).

3. The data set and the measurement of variables

The earnings forecasts used in this study are provided by a large, well-known brokerage house. From casual inspection, these are representative of companies listed on the London Stock Exchange. One advantage of this data set is that the precise creation date is available for all forecasts.[1] The importance of dating forecasts precisely is discussed by O'Brien (1988) with reference to forecasts on the International Brokers Estimate System (IBES), a commonly used source for earnings forecasts. O'Brien finds that the time between the creation of a forecast and its first appearance on IBES averages 34 trading days.

The selection criteria for the inclusion of an observation in this study are as follows:

- Earnings forecasts are available for the 22 months prior to an announcement.
- Both forecast and reported earnings numbers are positive. This is a common procedure used, for example, by O'Hanlon and Whiddett (1991) and Baldwin (1984), to eliminate (what might be) unusual observations and the need to interpret the percentages of negative numbers.
- There are no changes in the companies' lines-of-business, as identified by Dun & Bradstreet's *Key British Enterprises*, over the forecast period. Changes in a company's activities may provide an additional source of forecast error.

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[1] It is possible that an analyst may have constructed a forecast prior to this date and delayed its release, but since this is an inhouse database, it is unlikely that there would be significant incentives for such delays.

- There are no major changes in fiscal year-ends over the forecast period.

The above selection criteria lead to a final sample of forecasts for 197 company announcements, reporting over the fiscal periods 1987–90.

3.1. The Forecast Error Metric (FE)

This study uses forecasts made 22 months prior to the announcement of earnings for fiscal year t. The rationale for this is that evidence from surveys (Emmanuel and Garrod, 1987) and empirical studies (Baldwin, 1984) indicate that the impact of segment data is greatest for longer-term forecasts.

The error metric chosen is the absolute proportionate forecast error, used in a wide range of studies of analysts' forecasts, such as Basi, Carey and Twark (1976), Brown and Rozeff (1978) and Patz (1989). It is defined as:

$$FE_j = \frac{|F_{j,22} - A_{j,t}|}{A_{j,t}}$$

FE_j = forecast error for firm j

$A_{j,t}$ = reported earnings for company j for fiscal year t.

$F_{j,22}$= forecast of $A_{j,t}$ made 22 months prior to the announcement of $A_{j,t}$.

The two most commonly-used deflators for error metrics are actual earnings (used here), and forecasted earnings. Patz (1989) addresses the problem of selecting a suitable deflator.

> 'There is a practical problem with using actual earnings as the measurement base, since such measures are materially distorted when actual earnings are near zero...Yet it is difficult to circumvent the Lorek (1979) argument that the use of forecasted earnings as a base implies measurement of a firm's ability to achieve a predicted result, rather than a predictor's ability to forecast an outcome' (Patz 1989: 269, footnote 4).

Of the two points mentioned by Patz, it is the latter, the Lorek (1979) argument, that appears the stronger. The Lorek criticism of the use of forecasted earnings as a deflator is simple yet convincing. The first point Patz makes, regarding actual earnings values near zero, appears relatively weak because Patz gives no indication why actual earnings should be more likely to take values near zero than forecasted earnings. Another possible choice for a deflator is a market variable, e.g. the stock price or market value. However, Basi, Carey and Twark (1976) reject this approach for studies purely concerned with forecast accuracy.

> 'We avoided the temptation to use a price-normalised ..[error metric].. since we are looking at forecast errors themselves rather than at possible uses of the forecasts, such as in forming expectations about future price performance' (Basi, Carey and Twark 1976: 247).

The use of market value as a deflator would also mean that where two companies had identical reported earnings ($A_{j,t}$) and identical forecasted earnings ($F_{j,22}$), forecast errors would be lower for the company with the larger market value, implying greater accuracy. For a study concerned solely with forecast accuracy, this would not be a desirable outcome.

3.2. Firm Size (Market Value, MV)

Evidence that the share prices of larger companies convey more information about future earnings than the share prices of smaller companies is provided by a number of studies (Atiase, 1985; Bamber, 1986; Freeman, 1987; Collins, Kothari and Rayburn, 1987). In addition, several other studies also suggest a similar firm size effect in analysts' earnings forecasts. Brown, Richardson and Schwager (1987) find evidence that the superiority of analysts' forecasts over those generated by time-series models is positively related to market value. Patz (1989) also finds analyst forecast accuracy positively related to market value. Thus, market value is included as an explanatory variable in this study.

3.3. The Absolute Change in Earnings over the Forecast Period [EC]

The variability in past earnings is sometimes mentioned as an important factor determining forecast accuracy (e.g. Baldwin, 1984: 380). However, Barefield and Comiskey (1975b: 315–16) note that past earnings variability may not be a good proxy for the riskiness or uncertainty of future earnings. For this reason, the study here does not use a measure of past earnings variability but an ex post measure of the new information arriving over the forecast period.

$$EC_j = \frac{|A_{j,t-2} - A_{j,t}|}{A_{j,t}}$$

EC_j = absolute change in earnings, from year t-2 to year t.

$A_{j,t}$ = reported earnings for company j for fiscal year t.

$A_{j,t-2}$ = reported earnings for company j for fiscal year t-2, announced around two months prior to the creation of the forecast.

3.4. The Quality of Reported Segments [QLOB and QGEO]

Since the forecast horizon employed here is 22 months prior to the announcement of $A_{j,t}$, the rel-

Table 1
The quality of reported lines-of-business

QLOB	*Segment description*	
0	Broader than Division, or not consistent with a Division	
1	Division	(1-digit SIC)
2	Class	(2-digit SIC)
3	Group	(3-digit SIC)
4	Activity	(4-digit SIC)
5	Line-of-business	(5-digit SIC)
6	Finer than line-of-business.	

Note: Where no segmental information is disclosed, the consolidated accounts are treated as one segment. A quality measure is then given to this 'segment', based on the lines-of-business reported in the company's entry for that year in Dun & Bradstreet's *Key British Enterprises.*

Table 2
The quality of reported geographic areas

QGEO	*Segment description*
0	Broader than a single continent.
1	Single continent or group of individual countries.
2	Individual country.

Note: Where no segmental information is disclosed, the consolidated accounts are treated as one segment. A quality measure is then given to this 'segment' based on the geographic areas reported in the company's entry for that year in Dun & Bradstreet's *Key British Enterprises.*

evant published accounts for identifying segment definitions are those for fiscal year t-2 (published around 24 months prior).

For company j, each reported line-of-business segment (m = 1,2,...M) is assigned a quality score based on the UK's Standard Industrial Classification (SIC) system.[2] The SIC identifies activities at different levels of detail, from the broadest (*Divisions*) to the finest (*Lines-of-business*). These scores take values between zero and six, and are shown in Table 1.

To obtain a quality measure for the whole firm, these scores are weighted by sales.

$$QLOB_j = \sum_{m=1}^{M} \left[QLOB_{m,j} \cdot \frac{S_{m,j}}{S_j} \right]$$

$QLOB_j$ = quality of LOB segments (firm j).

$QLOB_{m,j}$ = quality of LOB segments (segment m of firm j).

$S_{m,j}$ = sales of LOB segment m of firm j.

S_j = total sales for firm j.

Sales are a convenient weighting variable. First, segmental analyses are more common for sales than for other items, such as profits, assets, etc. Second, the use of segment profits as a weighting variable would pose problems because it is not uncommon for individual segments to report losses. In addition, segment profits can be greatly distorted by the accounting treatment of common costs. In relation to the use of assets as a weighting variable, it must be noted that segment asset disclosures are much less frequent than segment sales disclosures, and also that the definition of assets disclosed in segment analyses differs across companies, i.e. net assets, total assets, etc.

A similar procedure is used to measure the quality of geographic segments. Individual geographic

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[2] This study uses the 1980 version of the SIC system.

Table 3
Descriptive statistics for the variables in this study

Whole sample: 197 observations used

Variable	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
FE	0.26561	0.47960	0.0000	4.634
EC	0.38357	0.25819	0.0064	2.507
MV	1563.4	2955.4	20.90	17380
QLOB	2.0219	1.4933	0.0000	6.000
QGEO	1.4974	0.57060	0.0000	2.000
NLOB	3.0812	2.0287	1.000	11.00
NGEO	3.9695	2.1874	1.000	10.00
A_t	163.17	338.23	1.970	2437.0
F_{22}	157.22	334.32	2.6	2500.0

Definitions

A_t = The reported earnings for year t (£m)
This variable is used as the deflator for FE and EC.
F_{22} = The 22-month ahead forecast of A_t (£m)
FE = Forecast error $= |A_t - F_{22}|/A_t$.
EC = Absolute change in earnings $= |A_t - F_{t-2}|/A_t$.
MV = Market value (£m).
QLOB = Quality of line-of-business segments ($0 \leqslant \text{QLOB} \leqslant 6$)
QGEO = Quality of geographical segments ($0 \leqslant \text{QGEO} \leqslant 2$)
NLOB = Number of reported lines-of-business.
NGEO = Number of reported geographic areas.

segments (n = 1,...N) are scored between zero and two, using the scoring system shown in Table 2.

Geographic segmentation can be either by geographic origin (i.e. where products are produced) or geographic market (i.e. where products are supplied to). A large proportion of companies that disclose geographic segment information do not identify the method of segmentation but simply refer to it as *analysis of geographic area.* Therefore, for practical purposes, this study makes no attempt to distinguish between geographic analyses by market and by origin. A minority of companies provide an analysis by both origin and market. If one analysis of sales is much more detailed than the other, then QGEO is calculated using the data for the more detailed analysis.

$$QGEO_j = \sum_{n=1}^{N} \left[QGEO_{n,j} \cdot \frac{S_{n,j}}{S_j} \right]$$

$QGEO_j$ = quality of GEO segments (firm j).
$QLOB_{n,j}$ = quality of GEO segments (segment n of firm j).
$S_{n,j}$ = sales for GEO segment n of firm j.
S_j = total sales for firm j.

3.5 The Number of Reported Segments [NLOB and NGEO]

This variable is included because some research indicates that analysts' incentives to revise forecasts, and therefore the accuracy of their forecasts, could be influenced by the number of lines-of-business. Bhushan (1989a) provides a theoretical analysis showing that the marginal information content of earnings announcements is a positive function of the number of lines-of-business. Evidence consistent with this hypothesis is given in Bhushan (1989b), where a significant negative association is found between the number of analysts following a company and the number of lines-of-business. This evidence would indicate that forecast errors may be positively related to the number of lines-of-business. There appears to be little evidence on the impact of the number of geographic segments on analysts' forecasts.

The number of lines-of-business (NLOB) and geographic areas (NGEO) for company j are the maximum number of segments reported for any accounting item. Invariably, this is the number of segments reported for sales data, in the annual report for fiscal year t-2.

Descriptive statistics for all variables are presented in Table 3.

Table 3 shows that the mean forecast error (FE) for these 22-month ahead forecasts is 0.265 or 26.5%. This result is very similar to the 25.4% mean forecast error reported by Patz (1989: 272) for UK analysts' long-term earnings forecasts. It can also be seen that the mean absolute change in earnings (EC) from fiscal year t-2 to year t, averages around 38%; however, there is great variation across companies. Absolute changes in earnings range from less than 1% to 250.7%. The same

Table 4
Correlation Matrix for the variables in this study

	1-FE	*2-EC*	*3-MV*	*4-QLOB*	*5-QGEO*	*6-NLOB*	*7-NGEO*
1-FE	1.0000000						
2-EC	0.7380385	1.0000000					
3-MV	−0.1555053	−0.1377198	1.0000000				
4-QLOB	−0.1284897	−0.1218936	0.2412721	1.0000000			
5-QGEO	−0.0634325	−0.0113306	−0.0116196	0.0052655	1.0000000		
6-NLOB	−0.0323810	−0.0784115	0.2736324	0.0850828	0.0412010	1.0000000	
7-NGEO	−0.0509888	−0.0103624	0.0776574	−0.0285036	0.0367170	0.2523447	1.0000000

Definitions: As for Table 3.

point can be made for the forecast error, which has an even greater range, from zero to 463%.

The metric for line-of-business quality (QLOB) averages around 2. This score is equivalent to segments with a 2-digit (*Class*) level of detail under the UK SIC system. The mean metric value for the quality of geographic segments (QGEO) is around 1.5, indicating a level of detail finer than continents, but broader than individual countries. This is consistent with the reporting practices of many UK companies; geographic segments are usually a mixture of continental segments and individual countries. It can also be seen that the sample of companies used for this study are diverse in terms of market values (MV) and the numbers of business and geographic segments (NLOB and NGEO). For additional information, the level of reported earnings (A_t)—used as a deflator for FE and EC—and the level of forecasted earnings ($F_{j,22}$), are also described in Table 3.

4. Model specification

One possible method of estimating the effect of segment definition on forecast error would be to analyse the variables in a linear additive regression model. However, this would be to assume that all variables have an independent impact on the forecast error. This is clearly not the case; the impact of the variables on the forecast error will obviously depend on the change in earnings over the forecast period. For example, if earnings change little over the two-year period, then there may not be much forecast error to explain. The correlation matrix in Table 4 shows that the forecast error (FE) and earnings change variable (EC) are highly correlated. It also shows that simple linear association between the forecast error and the segment quality measures (QLOB and QGEO) is of the expected sign, but is not strong.

Thus, the regression model is specified in a multiplicative format.

4.1. Regression Model 1

$FE_j = B_1 + B_2.EC_j + B_3.[MV_j\ .\ EC_j] + B_4.[QLOB_j\ .\ EC_j] + B_5.[QGEO_j\ .\ EC_j] + B_6.[NLOB_j\ .\ EC_j] + B_7.[NGEO_j\ .\ EC_j] + \varepsilon_j$

$B_{1,\ldots}B_7$ = regression coefficients.

ε_j = disturbance term following usual assumptions of zero mean and constant variance.

This form of model implies that the impact of each independent variable on the forecast error is determined by the regression coefficient and the magnitude of EC (see Pindyck and Rubinfeld, 1991: 103–04).

It should be noted that heteroscedasticity affects the regressions in this study; it is detected using the Breusch-Pagan (1979) test statistic, for which chi-squared tables may be used to assess significance levels. The statistic tests the null-hypothesis of homoscedastic errors; this null-hypothesis is rejected for the regressions carried out in this study. Traditional model transformations failed to solve the problem, so the White (1980) correction for heteroscedasticity is employed here. This procedure generates standard errors robust to heteroscedasticity, which may be used in conjunction with ordinary least squares (OLS) parameter estimates to construct t-values. The procedure has been utilised in a number of studies (e.g. Bhushan 1989b; Ali, Klein and Rosenfeld, 1992). The results for regression Model 1 are presented in Table 5.

The results reported in Table 5 support the use of the multiplicative regression format. Using either the OLS or the White (1980) t-values, significant slope coefficients are found for the following variables:

- *The absolute change in earnings over the forecast period (EC).* This coefficient generates a positive coefficient, as expected. The greater the change in earnings the analyst must predict, the larger the forecast error.
- *The company's size measured by market value (MV).* The negative slope for market value is consistent with the large amount of previous research on prices and analysts' forecasts, indicating that

Table 5
Explaining analysts' forecast errors: regression model 1

$$FE_j = B_1+B_2.EC_j+B_3[MV_j.EC_j]+B_4.[QLOB_j.EC_j]+ B_5.[QGEO_j.EC_j]+B_6.[NLOB_j.EC_j]+B_7.[NGEO_j.EC_j]+\varepsilon_j$$

Sample: All firms
Sample size: 197
Adjusted R-squared: 0.60
Breusch-Pagan (1979)χ^2: 145.2 (critical value = 12.6) indicating significant heteroscedasticity.

Variable	*OLS coefficient*	*OLS t-value*	*White t-value*
Intercept	−0.172	−4.00**	−2.33**
EC	1.83	11.33**	4.20**
MV^M	−0.00006	−2.53**	−3.27**
$QLOB^M$	−0.091	−2.56**	−2.47**
$QGEO^M$	−0.329	−3.58**	−2.29**
$NLOB^M$	0.054	2.25**	1.24
$NGEO^M$	−0.025	−1.07	−0.83

^{M}indicates multiplicative variable: $X^M = X\ .\ EC$
**significant at 0.05 level (two-tail test)
*significant at 0.10 level (two-tail test)

Definitions: As for Table 3

market participants' insight into future earnings changes is positively related to firm size.

- *The quality of line-of-business and geographic segments (QLOB and QGEO).* The negative coefficients for both QLOB and QGEO provide support for the main hypothesis of this study: that segment definitions do influence analysts' forecast errors. The finer the segment definition, the greater the predictive gains.

The number of lines-of-business (NLOB) generates a positive slope coefficient, consistent with the hypothesis that multi-segment forecasts are costly to generate, but the heteroscedastic corrected t-value is not significant at the 0.05 level. The number of geographic segments (NGEO) appears to have little impact on the forecast error.

Further analysis indicates that the results presented in Table 5 are primarily driven by a subsample of observations for which the change in earnings over the forecast period is negative. There are 21 observations in this sub-sample, and the descriptive statistics are presented in Table 6.

The special nature of these observations has been noted in previous studies of analysts' earnings forecasts. Studies of UK analysts' forecasts, by Cooper and Taylor (1983) and Cooper (1984), make note of analysts' failure to identify changes in the direction of earnings changes. The difficulty analysts have in predicting falling earnings numbers may be seen by comparing the mean values of the forecast error (FE) and the earnings change (EC) for the whole sample (Table 3) and the sub-sample of firms with falling earnings (Table 6). The mean absolute earnings change for firms with falling earnings is only 1.32 times larger than for the whole sample; however, the mean forecast error is larger by a factor of 4.05. Of course, error metric volatility may also be due to observations where the level of actual earnings—which is used as the deflator for EC and FE—are small.[3]

To provide a test of the importance of the negative earnings change sub-set on the regression results presented earlier, the regression model is repeated, with dummy variables introduced on the intercept and all slopes; this dummy represents negative earnings changes.

4.2. Regression Model 2

$$FE_j = B_1 + B_{D1}.D_{1j} + B_2.EC_j + B_{D2}.[D_{2j}.EC_j] + B_3.[MV_j.\ EC_j] + B_{D3}.\ [D_{3j}.\ MV_j.\ EC_j] + B_4.[QLOB_j.\ EC_j] + B_{D4}.\ [D_{4j}.\ QLOB_j.\ EC_j] + B_5.[QGEO_j.\ EC_j] + B_{D5}.\ [D_{5j}.\ QGEO_j.\ EC_j] + B_6.[NLOB_j.\ EC_j] + B_{D6}.\ [D_{6j}.\ NLOB_j.\ EC_j] + B_7.[NGEO_j.\ EC_j] + B_{D7}.\ [D_{7j}.\ NGEO_j.\ EC_j] + \varepsilon_j$$

$B_1, \ldots B_7$ = regression coefficients.
$B_{D1}, \ldots B_{D7}$ = coefficients for intercept and slope dummies.
$D_{1j}, \ldots D_{7j}$ = negative earnings change dummy for firm j
$D_1 \ldots\ldots D_7$ take same value for firm j (i.e. 1 if earnings change is negative, and 0 otherwise). The sub-

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[3] See Test 2 in Section 5.

Table 6
Descriptive statistics for firms with negative earnings changes

21 observations used

Variable	*Mean*	*Std. Dev.*	*Minimum*	*Maximum*
FE	1.0774	1.1276	0.1669	4.634
EC	0.50585	0.62739	0.0064	2.507
MV	260.49	496.75	22.30	2284.0
QLOB	1.6776	1.2986	0.0000	5.300
QGEO	1.4223	0.65037	0.0000	2.000
NLOB	2.8571	2.2646	1.000	8.000
NGEO	3.7143	1.9011	1.000	7.000
A_t	29.096	49.945	1.97	223.4
F_{22}	54.852	104.44	3.0	490.0

Definitions: As for Table 3.

scripts 1,...7 are merely used to identify which coefficient the dummy relates to.

ε_j = disturbance term following usual assumptions of zero mean and constant variance.

The results for regression Model 2 are presented in Table 7.

The results in Table 7 provide support for the hypothesis that a sub-set of observations is driving the results presented in Table 5. The regression results indicate the following:

- The coefficient for the intercept dummy D_1 is positive and significant. This provides evidence of the greater level of forecast error where earnings changes are negative.
- Both the slope coefficient (B_2) and the slope dummy (B_{D2}) are positive and significant. This supports the positive association between the magnitude of the earnings change and the forecast error. The coefficient determining this relationship is larger where earnings changes are negative.
- The impact of market value remains unaffected by poor earnings performance. The slope coefficient (B_3) is negative and significant, while the slope dummy (B_{D3}) is not significant at any reasonable probability level.
- The slope coefficients for the quality of lines-of-business (B_4) and geographic areas (B_6) are no longer significant, but the respective slope dummies (B_{D4} and B_{D5}) are both negative and significant. This suggests that the impact of segment quality is most important for earnings forecasts for companies with negative earnings changes.

The coefficients for non-dummy variables (B_1,...,B_7) represent the coefficients for the sub-set of companies with positive earnings changes, assuming both positive and negative earnings change sub-sets have a common error structure. This can be checked by running regression Model (1) for the 176 firms with positive earnings changes. The estimated coefficients—not reported here—are materially similar to those for the non-dummy variables in Table 7.

5. Discussion and additional analyses

The results of regression Models 1 and 2 (see Tables 5 and 7) provide further support for the firm size effect in analysts' earnings forecasts. The results show a significant negative association between the market value (MV) of a firm and the magnitude of the forecast error. This finding is consistent with the wider sets of information available for large firms, and also with the greater financial incentives for analysts to follow large firms. Large firms offer greater opportunities for profitable trading where mispriced securities are identified.[4]

The absolute change in earnings (EC) over the forecast period is the main explanatory variable in these multiplicative regression models. As expected, there is a strong positive association between EC and the forecast error (see Tables 5 and 7). However, it is interesting to note that the coefficient for the slope dummy—variable D_2 in Table 7—is also positive and significant. This indicates that large earnings changes have an even greater impact on the forecast error where earnings changes are negative. This finding is consistent with the suggestion that analysts have special difficulty in predicting earnings for this sub-set of firms.

The quality of both line-of-business segments (QLOB) and geographic segments (QGEO) have a significant negative association with the forecast error (see Table 5). This is consistent with the improved insight that segment data gives analysts, especially at longer horizons [e.g. Baldwin, 1984]. However, once dummy variables for negative

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[4] For a discussion of this issue, see Freeman (1987: 196–98).

Table 7
Explaining analysts' forecast errors: regression model 2

Sample: all firms
Sample size: 197
Adjusted R-squared: 0.89
Breusch-Pagan (1979)χ^2: 69.9 (critical value = 22.4) indicating significant heteroscedasticity.

$$\begin{aligned} FE_j = {} & B_1 + B_{D1}.D_{1j} + B_2.EC_j + B_{D2}.[D_{2j}.EC_j] + B_3.[MV_j.EC_j] + \\ & B_{D3}.[D_{3j}.MV_j.\ EC_j] + B_4[QLOB_j.\ EC_j] + B_{D4}.[D_{4j}.\ QLOB_j.EC_j] + \\ & B_5.[QGEO_j.\ EC_j] + B_{D5}.[D_{5j}.\ QGEO_j.\ EC_j] + B_6.[NLOB_j.\ EC_j] + \\ & B_{D6}.\ [D_{6j}.\ NLOB_j.\ EC_j] + B_7.[NGEO_j.\ EC_j] + B_{D7}.\ [D_{7j}.\ NGEO_j.\ EC_j] + \varepsilon_j \end{aligned}$$

Variable	*OLS coefficient*	*OLS t-value*	*White t-value*
Intercept	0.027	0.87	0.63
D_1	0.307	4.61**	3.25**
EC	0.472	3.33**	3.29**
D_2.EC	2.198	9.26**	10.77**
MV^M	−0.00003	−2.17**	−3.08**
$D_3.MV^M$	0.00004	0.46	0.57
$QLOB^M$	−0.009	−0.42	−0.57
$D_4.QLOB^M$	−0.321	−4.34**	−2.56**
$QGEO^M$	0.012	0.22	0.25
$D_5.QGEO^M$	−0.570	−3.85**	−4.69**
$NLOB^M$	−0.057	−1.21	−1.32
$D_6.NLOB^M$	0.007	1.31	1.54
$NGEO^M$	0.0004	0.01	0.01
$D_7.NGEO^M$	0.0014	0.284	0.36

^{M}indicates multiplicative variable: $X^M = X\ .\ EC$
**significant at 0.05 level (two-tail test)
*significant at 0.10 level (two-tail test)

Definitions:
$D_{1j},..D_{7j}$ = Negative earnings change dummy for firm j.
A_t = The reported earnings for year t (£m).
This variable is used as the deflator for FE and EC.
F_{22} = The 22-month ahead forecast of A_t (£m)
FE = Forecast error = $|A_t - F_{22}|/A_t$.
EC = Absolute change in earnings = $1A_t - A_{t-2}|/A_t$
MV = market value (£m).
QLOB = Quality of line-of-business segments ($0 \leq QLOB \leq 6$).
QGEO = Quality of geographic segments ($0 \leq QGEO \leq 2$).
NLOB = Number of reported lines-of-business.
NGEO = Number of reported geographic areas.

earnings changes are introduced (see Table 7) it can be seen that these associations are driven by the sub-set of firms with negative earnings changes. It may be that the forecasting processes used by analysts are poor predictors of earnings where earnings are falling; only with good segmental data are analysts able to gain sufficient insight to overcome this problem. However, it may also be that there are incentives for analysts to avoid generating excessively pessimistic forecasts—relative to the realised outcome—because it may damage relations with company managers (see O'Brien, 1988: 65). Thus, only when analysts have sufficient segment data to make them confident of their forecasts do they predict earnings reductions; where they are less well informed (e.g. poor segmental data) they may be reluctant to commit themselves to predictions of poor earnings performance.

An important aspect to any empirical analysis is the robustness of the results. The results obtained in this study appear robust to a number of additional tests suggested by colleagues and re-

Table 8
Explaining analysts' forecast errors: additional tests

$$\begin{aligned}FE_j = {} & B_1 + B_{D1}.D_{1j} + B_2.EC_j + B_{D2}.[D_{2j}.EC_j] + B_3.[MV_j.\ EC_j] + \\ & B_{D3}.[D_{3j}.MV_j.EC_j] + B_4.[QLOB_j.\ EC_j] + B_{D4}.\ [D_{4j}.\ QLOB_j.\ EC_j] + \\ & B_5.[QGEO_jEC_j.] + B_{D5}.\ [D_{5j}.\ QGEO_j.\ EC_j] + B_6.[NLOB_j.\ EC_j] + \\ & B_{D6}.\ [D_{6j}.\ NLOB_j.\ EC_j] + B_7.[NGEO_j.\ EC_j] + B_{D7}.\ [D_{7j}.\ NGEO_j.\ EC_j] + \varepsilon_j\end{aligned}$$

	Test 1	*Test 2*	*Test 3*
Variable	*Coefficient*	*Coefficient*	*Coefficient*
Intercept	−0.001	0.012	0.025
D_1	0.220*	0.24**	0.323**
EC	0.816**	0.384**	0.477*
D_2.EC	2.14**	5.04**	5.99**
MV^M	−0.00003**	−0.00002**	−0.00003**
$D_3.MV^M$	−0.00007	−0.00001	0.000005
$QLOB^M$	−0.018	0.007	−0.028
$D_4.QLOB^M$	−0.21**	−1.33**	−1.28**
$QGEO^M$	−0.037	0.088*	0.023
$D_5.QGEO^M$	−0.63**	−1.55**	−2.04**
$NLOB^M$	−0.037	−0.029	−0.039
$D_6.NLOB^M$	0.006	0.004	0.006
$NGEO^M$	−0.104	−0.033	−0.008
$D_7.NGEO^M$	0.011*	0.004	0.002
Adjusted R-squared	*0.89*	*0.68*	*0.90*

^{M}indicates multiplicative variable: $X^M = X\ .\ EC$
**White (1980) t-value significant at 0.05 level (two-tail test)
*White (1980) t-value significant at 0.10 level (two-tail test)

Definitions: As for Table 7.

Test 1: Eliminating single segment firms (119 observations).
Test 2: Eliminating firms with reported earnings <£20m (136 observations).
Test 3: Non-linear transformation of segment quality metrics (197 observations).

viewers, and detailed below. The results of these tests are contained in Table 8.

5.1. *Test 1: Eliminating Single Segment Firms*

This study includes single segment firms: in such cases, the consolidated accounts are treated as a single segment. Such reporting is quite adequate if the company is engaged in a single line-of-business or geographic region. With the aid of *Key British Enterprises*, a judgment is made as to an appropriate quality score for QLOB and QGEO. It could be argued, however, that these firms represent a special sub-set of the data which may have different properties from the rest of the sample. Regression 2 is therefore repeated, excluding all firms with single lines-of-business or geographic regions. This reduces the sample size to 119.

5.2. *Deflator Choice and Metric Volatility*

The metrics used for measuring forecast error (FE) and earnings change (EC) both use the level of reported earnings as a deflator. Very low values for earnings may result in excessive volatility for both FE and EC. While wishing to retain reported earnings as the deflator (for reasons given earlier), Table 3 shows that the minimum value for reported earnings is 1.97 (i.e. £1.97m). It can also be seen that the EC range is from 0.00649 to 2.507. Both of these extreme observations are for poor earnings performers. It could be that these two extreme EC observations are driving the results. Both are eliminated when a minimum value of £20m is placed on reported earnings; the range of values for both FE and EC are greatly reduced from the values reported for the whole sample, in Table 3. Eliminating observations where earnings are less than £20m reduces the sample to 136, and reduces the range for the FE and EC variables. The FE ranges from zero to 1.864, while the EC variable ranges from 0.0298 to 1.282.

5.3. *Test 3: The Ordinal Nature of Quality Scores*

The quality scores used for lines-of-business and geographic segments are ordinal in nature. They indicate that one level of detail is superior to another, but do not indicate the magnitude of the superiority. This is unavoidable because of the nature of the study: there is no cardinal measure of quality. However, it may be that by changing the weightings for quality, different results may be obtained. To test this hypothesis, both the QLOB and QGEO scores are transformed thus:

$$NewQLOB = \sqrt{(QLOB+1)}$$

$$NewQGEO = \sqrt{(QGEO+1)}$$

These transformations alter the relative importance of good and bad segmental definitions. Regression 2 is re-estimated with the transformed QLOB and QGEO scores.

The results of these three tests, described in Table 8, indicate that the results are quite robust to a number of sensitivity tests. However, before concluding, a number of possible limitations to this study should be acknowledged.

- The forecasts used in this study are generated by analysts employed by one brokerage house. It could be that the forecasts are not representative of analysts' forecasts as a whole. It should be noted, however, that the brokerage house from which the forecasts originate is one of the largest in the City of London, and has a well resourced equities-research department.
- There is potential measurement error in the metrics for segment quality. However, this is unavoidable; there is no precise measure of segment quality. In addition, the results of this study appear robust to the non-linear transformation of these quality metrics.
- There may be additional explanatory variables omitted from this study. For example, there is no control over analyst-specific factors which may influence forecast accuracy. Technical skill (e.g. use of forecasting tools) and educational background (e.g. knowledge of accounting, statistics, economics) may differ greatly across analysts. However, these data are not readily available to researchers and so cannot be controlled for.
- It is possible that predictive gains resulting from a particular level of segment fineness may differ across firms, because of differences in organisational structure. It may be that an increase in the quality of business segments from, say, QLOB = 3 to QLOB = 6 may have a smaller effect where a company is engaged in a number of distinct but similar activities that respond similarly to economic changes, than where a firm is engaged in a number of very different activities with differing responses to economic changes.

6. Conclusion

This study examines UK analysts' forecasts of annual earnings, generated at a 22-month horizon prior to the earnings announcement. The results indicate that a firm size effect occurs in analysts' forecasts, similar to that observed in stock prices. Forecasts for large firms better reflect forthcoming earnings information than forecasts for smaller firms. It is also found that forecast errors are positively associated with the magnitude of the change in earnings that analysts must predict. This association is particularly strong where earnings changes are negative. However, where firms provide good quality segmental disclosure for lines-of-business and geographic regions, the forecast error is reduced. These results provide further evidence of the superior insight that analysts obtain from segmental disclosure.

A possible implication from these findings is that, if the aim of segmental reporting is to provide investors with improved insight into corporate prospects, then accounting standards should concern themselves more with improving the definitions of reported segments, and concern themselves less with attempts to extend existing segmental reporting requirements to a wider range of (possibly) less useful accounting items.

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The Role of Resource Accounting in the UK Government's Quest for 'Better Accounting'

Howard Mellett*

Abstract—The UK government intends to introduce resource accounting to central government departments under the banner of 'Better Accounting for the Taxpayer's Money'. Under the proposed system of resource accounting, as outlined in a White Paper, an annual depreciation charge is to be incorporated in the cost statement and fixed assets included in a balance sheet at their depreciated replacement cost. This paper locates the proposed changes in accounting method for government departments in the general spread of accruals accounting through the public sector, and explores the relevance of accruals as a basis for measuring the results of activity undertaken by government departments. It goes on to examine the impact of the specific accounting change envisaged in the White Paper from both theoretical and practical aspects. The benefits envisaged in the White Paper are considered along with the extent to which they are likely to be realised, together with any consequences not explicitly foreseen. The conclusion is that, while the revised accounting techniques may be different, the proposition implicit in the White Paper's title that they are better is not proven by the evidence presented.

1. Introduction

In his November 1993 Budget, the Chancellor of the Exchequer announced the proposed introduction of resource accounting[1] to UK central government departments. This was followed by a Consultation Paper in July 1994 (HMSO, 1994), which specified that resource accounting would be implemented in the majority of government departments by 1 April 1997 and in all departments by April 1998. Subsequently, a White Paper was published in July 1995, which states that 'the first published accounts will be in respect of 1999–2000' (HMSO, 1995: 46).

One of the consequences of the move to resource accounting will be to use accruals, rather than cash, to measure and report the costs of activities, and this will involve the introduction of a depreciation charge into the operating cost statement and the inclusion of depreciated fixed assets in the balance sheet. This paper reviews the form of, and drivers for, the introduction of accruals accounting, with a particular emphasis on depreciation accounting and the possible consequences of its use.

Depreciation accounting is the process by which fixed assets are assigned values that are allocated to the accounting periods during which the assets provide service. The amount allocated to each period is recognised as part of the cost of the activity carried out, and the amount not yet allocated at a particular date is included in a valuation statement. The concept of depreciation has a long history, being known in Roman times (Edwards, 1989: 84), and 'The practice of charging depreciation [by businesses in the UK] became more common after 1800...' (Edwards, 1989: 84). In the UK private sector, the move towards its universal use was steady, and it is now required by both legislation and standard accounting practice.

The public sector has a less established history of depreciation accounting, although a debate about its relevance was certainly taking place by the start of this century (Coombs and Edwards, 1992; Edwards, 1992), and its adoption has been incremental, with separate parts adapting it to their own particular circumstances. The lack of uniformity, covering both whether to use depreciation accounting and, if so, the basis of the underlying calculations, is not surprising: the public sector has a considerable diversity of activities and aims. Thus, the term 'public sector' encompasses a large number of diverse organisations, each with

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*The author is a lecturer in accounting at the Cardiff Business School. He would like to thank delegates to the Cardiff SWAG conference, his colleagues at Cardiff Business School, Professor Rowan Jones, and two anonymous referees for their helpful comments on earlier drafts of this paper. Correspondence should be addressed to the author at the Cardiff Business School, Aberconway Building, Colum Drive, Cardiff CF1 3EU. This paper was first submitted in February 1996 and accepted in November 1996.

[1] Definition: 'Resource accounting comprises a set of accruals accounting techniques for reporting on the expenditure of central government and a framework for analysing expenditure by departmental aims and objectives, relating these to outputs where possible' (HMSO, 1995: 49).

its own accounting procedures developed over the years.

By the late 1970s, a range of accounting procedures for depreciation had evolved throughout the public sector. In some cases, where a predominantly market ethos existed, a system of depreciation accounting as found in the private sector was applied (Henley et al., 1983: 23), especially for nationalised industries where the requirement to use 'commercial' accounting was laid down by statute (for a summary, see Henley et al., 1983: 142–143). Alternatively, organisations either had some element analogous to depreciation, for example local authorities' practice of including a portion of loan principal in the annual revenue account (Jones and Pendlebury, 1992: 167), or else they ignored depreciation altogether (Likierman and Taylor, 1990: 36). Perrin (1984) noted that nationalised industries and public corporations broadly followed the same conventions as found in commercial accounting, while central government generally did not capitalise or depreciate fixed assets (Perrin, 1984: 64). However, whatever the starting position of the individual parts, the trend has been for depreciation accounting to be advocated throughout the public sector, sometimes driven by external pressures, such as seeking a flotation of shares, and at other times through internal consideration, as was the case with local authorities (Jones, 1993: 105–112).

Different routes have led to the adoption of depreciation accounting by the separate parts of the public sector. Those parts that traded in a commercial environment, such as coal or steel, used depreciation accounting as an accepted principal of how such organisations should account for their activities, and retained it when taken from the private sector into public ownership, although the precise wording of the accounting requirements varied from industry to industry (Henley et al., 1983: 142–143). In other cases, its adoption was an imperative arising from policy decisions. For example, the privatisation of British Telecom required the creation of a commercially-based entity to encompass activities previously conducted as part of a government department. To be ready for transfer to the private sector by the sale of its shares, the accounts had to use the techniques appropriate to that sector. In the case of the National Health Service, rather than being driven by the requirements of privatisation, a quasi-market for health care was established using the full cost, including depreciation, of the procedures traded (HMSO, 1989: 12). NHS Trusts were established to mimic private sector providers and pursue their objectives as separate entities; this imitation includes the use of depreciation accounting. Similarly, Executive Agencies established as trading funds produce accounts that conform to the requirements of the Companies Acts (Pendlebury et al., 1994: 33).

Another route to the use of depreciation accounting in the public sector has recently arisen. In 1994, the government produced a Consultation Paper (HMSO, 1994) as a first step towards the use of resource accounting in government departments. It recognises that 'One of the most important single changes in the proposed system is the improved treatment of capital' (p. 4). This will involve the switch from accounting for flows on the cash basis to the preparation of cost statements, including depreciation, and a balance sheet containing fixed assets at their written-down value. The proposers of the change indicate that accounting will not be a 'mere technical discipline' (Jones, 1994: 109) but 'a technology that actively (and politically) constitutes the world rather than passively (and neutrally) regulates and/or reports it' (Morgan and Willmott, 1993: 4). The Consultation Paper intends that the use of resource accounting will be more than a measurement exercise, as it is foreseen that it will 'require a substantial change in ...[department's]... working methods and cultures' (HMSO, 1994: iii). Depreciation accounting is being used as a policy in its own right, rather than just as an adjunct to some other objective.

The White Paper describes the change it proposes as 'a milestone in modernising the state' that will make 'better management of public spending' possible (HMSO, 1995: i). However, as Mayston (1993: 76) has noted: 'Simply transplanting the private sector accounting model to the public sector ... may then impose substantial costs but uncertain benefits.' Furthermore, accounting change cannot be viewed in isolation, even if it is the subject of its own White Paper. Lawrence et al. (1994: 70) show 'how accounting technologies and practices are so "fabricated" as integral parts of broader social and institutional changes', while accountants 'make the picture ...[and]... people think and act on the basis of that picture!' (Hines, 1988: 254).

Against this background, this paper's purpose is to outline the operation of accruals accounting as envisaged by the White Paper and its impact on accounting reports. It investigates whether the accounting theories developed in respect of depreciation accounting provide a justification for its adoption, or whether it is simply the byproduct of external forces consistent with the implementation of government policies. In the latter case, the relationship between the proposed accounting system and the extent to which accruals accounting can assist, or hinder, the achievement of policy goals will be examined. The paper concludes that, given the incorrigible nature of depreciation measures, the questionable relevance and accuracy of valuation bases, and the inability of managers to control costs based on accounting allocations, the use of accruals accounting may not warrant the description 'better', used by the government in its publications.

2. Measuring and reporting government department results

The Treasury has recently published a draft set of accounting policies (H M Treasury, 1995). In summary, these use the framework of Generally Accepted Accounting Practice as operated in the UK, but adapt it where necessary to accommodate the circumstances of government departments. In consequence, the accounting concepts and conventions to be applied include the usual ones of going concern, accruals, consistency, prudence and materiality, together with one described as a 'central government specific accounting convention' (H M Treasury, 1995: 4) called 'notional cost items', which are included to show the full cost of service provision even though there has not been, and will not be, a related cash transaction.

The usual valuation basis for tangible fixed assets is to be net current replacement cost, with property included in the balance sheet at its open market value for existing use. There are some categories, such as heritage and military assets, which, it is recognised, will require special treatment in terms of recognition and valuation, but this has yet to be formulated. The absence of a current policy for these assets and the stated intention to issue a code of practice suggests that the decision to implement accruals accounting was taken prior to full consideration of the consequences, and ignores the chance that it may not be possible to generate a meaningful approach in this area.

Depreciation is to be provided for all fixed assets with a finite useful life, including intangible fixed assets, which are to be capitalised at their fair value on purchase or acquisition, and amortised. In addition to depreciation and amortisation, the government 'intends to develop mechanisms whereby departments are charged for the cost of their capital employed' (HMSO, 1995: 10). No further information is provided on how this charge is to be calculated, but the intention to operate it is clear from the specimen accounts provided in the White Paper (HMSO, 1995: 35). In this respect, the White Paper is less developed than its preceding Consultation Paper, which suggested alternative ways of reflecting the opportunity cost of capital by departments (HMSO, 1994: 9).

The White Paper lists five principal financial reports, which together will comprise the Annual Departmental Resource Accounts to be prepared by government departments ranging from Agriculture to the Welsh Office (HMSO, 1994: 48–52). The reports are given in Table 1 together with a brief description of their purpose, a link to their private sector equivalent and brief comments.

It is interesting to note that the original Consultation Paper places accruals accounting at the heart of resource accounting, and observes that it is already established in many parts of the public sector, such as nationalised industries and the NHS (HMSO, 1994: iii). However, the form of the accounting reports given in Table 1 reveals significant differences between the system now proposed and that already operated elsewhere in the public sector. More specifically, the use of the operating cost statement, rather than an income and expenditure account, has the effect that the operating resources that come under the organisation's control are not compared with those expended. In consequence, the amount by which the resource base has grown, or been eroded, as a result of operations is not revealed. This is even at variance with the accounting policies put forward to implement resource accounting, which state: 'The matching or accruals concept requires that "income and expenditure are accrued ...[and] matched with one another so far as their relationship can be established or justifiably assumed ..." ' (H M Treasury, 1995: 5).

3. Depreciation accounting

Accruals accounting involves two main areas of change relative to cash-based accounts: adjusting revenue income and expenditure cash flows for changes in working capital balances, and operating a system of depreciation accounting. Cash flows and working capital balances are relatively straightforward to establish, as they are based on transaction values, and so the second of these is the more radical—it will result in the accounts including the depreciated value of the stock of capital assets and a charge for their use during the year. Further complexity arises because the valuation basis is decoupled from the related transactions, as valuation is to be at current cost, and depreciation is a 'non-cash expense'.

Private sector techniques do not have to be slavishly adopted by the public sector, and it is possible for an entity to report in terms of income and expenditure only items of a revenue nature, as did the system that existed in the NHS for many years (Mellett, 1992). This view was recognised in 1990 by the chief accountancy adviser to the Treasury and head of the Government Accountancy Service who wrote:

> 'The Next Steps initiative...will inevitably bring into government reporting some of the features of private sector accounting practices. However, it is important to resist the temptation to assume that this will lead to public sector accounting and reporting assuming every characteristic of the private sector. There are fundamental differences be-

Table 1
Principal financial reports

Accounting report (HMSO, 1995: 25)	*Summary of resource outturn*	*Operating cost statement*	*Balance sheet*	*Cash flow statement*	*Statement of resources*
Purpose	Compares outturn with estimate by vote to provide Parliamentary control	Shows administrative and programme costs	Reports assets, liabilities, reserves and general fund	Analyses net cash outflows by operating and investing activities	Analyses results by aim and objective
Private sector equivalent	Summary master budget variance analysis	Income and expenditure account; profit and loss account	Balance sheet	Cash flow statement	Segmental analysis
Comment	Specialised report with no published private sector counterpart	Mixes elements of income and expenditure to arrive at the 'net resource outturn'	Standard Companies Act format amended for public sector	Starts with the total cost figure using accruals and adjusts it to the cash basis	Specifies the aims and objectives of the department and links them with their associated expenditure

> tween the two and, while any examples of valuable concepts or best practice from the private sector will be adopted where they yield an advantage, these differences remain' (Hardcastle, 1990: 28).

Seeking an answer to the question of why depreciation accounting is deemed to be a valuable concept worthy of transfer to government departments would be greatly assisted if it could be put in the context of an overarching conceptual framework. However, as Jones (1992: 260) states: 'What remains clear, for the private sector and the public sector, is that we have no generally-accepted theory or evidence about the purpose of the publication of financial statements.' Without agreement on the purpose, it is not possible to proceed to the stage of deciding what valuation basis to adopt. Alternatively, reasons can be sought for the spread of depreciation accounting to the public sector in a more piecemeal manner by examining both theoretical and practical aspects, and these are now considered below.

3.1. Theoretical Aspects of Depreciation Accounting

From the theoretical viewpoint, the concept of depreciation as a cost is well established. For example, Leake (1912: 33) stated: 'It cannot by any means be denied that depreciation...is as much a part of economic cost as is, for instance, the sum paid by the manufacturer for wages.' The conceptual case in favour is developed in the early work of Hicks (1946), who defined a person's income as:

> 'the maximum value which he can consume during a week, and still expect to be as well off at the end of the week as he was at the beginning.' (p. 172), and, 'If a person's receipts are derived from the exploitation of a wasting asset...we should say that his receipts are in excess of his income, the difference between them being reckoned as an allowance for depreciation' (p. 187).

Hicks therefore views depreciation as a necessary charge to arrive at a measure of income, and by 1955 it was contended that 'The struggle to get depreciation recognised as a cost appears to have been won' (Goldberg, 1962: 238).

However, even if over the years depreciation has been accepted as an element of cost, problems of operationalisation have been identified and remain. When discussing the controversial nature of depreciation, Bonbright (1937: 189) refers to 'the inherent difficulties of *measurement*—difficulties to which no experts have yet found satisfactory solutions'. The consequence of these difficulties is spelt out by Baxter (1981: 2): 'Depreciation measures can have a great effect on a company's results, yet they are chosen from a wide range of possible figures, by rules that are vague and little understood.' Rather than address the measurement problems, an alternative view is represented by Thomas. He classifies the assets that give rise to depreciation as 'multi-year goods' (1969: 3) and argues elsewhere that, since allocating the cost of such assets to separate accounting periods is an incorrigible, or arbitrary, procedure, the resulting figures are essentially meaningless and irrelevant:

> 'They [allocations] have been rejected as being unrelated to the purported topic of financial statements: a firm's economic state and activities. They have no more significance for these economic matters than do the calculations of astrologers.' (Thomas, 1974: 63)

Despite the existence of convincing arguments against depreciation accounting and its associated problems, the fact is that it is deemed appropriate for use by government departments, and so explanations must be sought for this empirical observation, to account for the adoption of what, on a priori grounds, is at best a necessary, but flawed, method. Hence, in line with the positive approach of Watts and Zimmerman (1986), the adoption of depreciation accounting in the public sector is an observed phenomenon to be explained by the fact that its use is perceived to confer a benefit on those causing it to be implemented. The positive approach to theorising, which requires the theory to 'explain and predict accounting practice' (Watts and Zimmerman, 1986: 2), examines the motives underpinning the introduction of depreciation accounting by reference to its impact on the various contractors. Where central government provides resources and specifies the accounting policies to be used, it can be viewed as the principal, while the departments are the agents contracted to implement the government's policies.

The use of depreciation accounting, as envisaged in the White Paper, can be considered at two levels: there are general features of the technique that apply wherever it is used, and there are also properties that are peculiar to its use by government departments.

At the general level, in the context of the firm as a whole, Zimmerman (1979) develops examples that 'suggest that cost allocations might be useful devices for controlling and motivating managers' (p. 504). In a theoretical example, he shows how an allocation of overheads acts as a lump sum tax to reduce discretionary spending on perquisites in a principal-agent scenario. The broader question of how to identify principals and agents in the public sector presents specific problems (Mayston, 1993: 76), but the existence of an accountability relationship gives evidence of such a relationship. Using this approach in the context of the White

Paper, central government, or more precisely the Treasury, is revealed as the ultimate principal and the various spending departments as the associated agents.

Making each agent include depreciation in its costs has an upward effect at a time of rising asset values, which may impact on its ability to extract additional resources from the government; the extent to which additional capital charges are not approved must be met by a squeeze on revenue expenditure. Reported anecdotal evidence suggests that spending on perquisites for managers does take place, but, by creating downward pressure on all costs, it is possible that a minimising, or reducing, effect takes place. Departments may request more resources because costs are rising, but the extent to which this is met will be conditioned by whether the government wants to be seen to be 'squeezing' the resources consumed by the public sector. On the other hand, if the government simply provides resources equal to the capital charges, any hope of encouraging managers to optimise their use of capital assets is removed.

Pallot (1992: 52) contrasts the property dimension of assets with the resources dimension, and suggests that concentration on the former in the public sector would provide a necessary framework of accountability. The private sector relies on the latter, as its accounting procedures have been based more on a decision-usefulness approach which, even if more apparent than real, is acknowledged as an objective of the sector's financial statements (Accounting Standards Board, 1991: para. 12). The introduction of full accruals accounting for government departments, together with a balance sheet that includes a value for fixed assets, changes the perception of those assets. They now appear as resources to be dealt with in the same way a commercial firm uses its fixed assets. The rights of property appear to have shifted from the community to a specific entity which will deal with them in its own, or more realistically its managers', interests. While Berle and Means (1932) analysed the divorce between the ownership and control of assets in the context of private sector undertakings, Jones (1993: 124) differentiates the position of government since 'government is "ownership" *compulsorily* divorced from "control".' In these circumstances, depreciation accounting is giving visibility to the fact that the ownership of assets held by the government, and ostensibly 'owned' by the public, has been divorced from their control, which is exercised by the executives and managers of the entities in whose balance sheet they appear.

Mautz (1988) examines public sector fixed assets from the viewpoint of the cash flows that result from their ownership. He argues that, although something, such as a national monument, may be regarded as a 'treasure' of great value, to the entity charged with its upkeep it in fact has a negative value. This is because ownership of the asset brings with it nothing but expense, and the present value of an indefinite negative income stream must itself be negative. The current proposals do not go as far as identifying government departments as revenue generating units, and so the nature of their fixed assets has not changed. To this extent, the White Paper reforms are not the same as in other parts of the public sector, such as the NHS, where assets are held for their revenue-producing potential and so are expected to deliver positive future cash flows.

Ijiri (1978: 145) addresses an aspect of reliability with the question of 'how well the user understands the accounting process by which the measure is made'. Evidence suggests that there is general backing for the concept of depreciation in that a survey of Health Authority Finance Officers concluded that 'there is clear support for a system of depreciation accounting' (Lapsley, 1986: 293), and, in a study in 1993 of the financial awareness of health service managers (Marriott and Mellett, 1995), 78% of respondents answered 'yes' to the question: 'Do you agree that it is a good idea to charge depreciation on capital assets?'. However, only 41% identified the correct definition of a fixed asset, and only 34% could identify the correct written-down value of a fixed asset after one year's depreciation and revaluation. Clearly, these levels of lack of awareness bring into question the reliability of the depreciation accounting system under the criterion of how well its users understand its output, and there is no reason to suppose that greater levels of awareness exist in government departments than were found elsewhere.

Anthony (1989: 95) espoused the view that 'nonbusiness accounting should be the same as business accounting in most respects', with one of the main areas of difference relating to 'contributed capital'. The public sector, unlike the private, has in its possession assets that have accrued to it by way of gift; the asset itself may be given directly, or the funds to enable its purchase may be provided by benefactors. These assets raise accounting problems once it has been decided that full accruals accounting should be used. The first problem is whether they should be included in the accounts at all, and the second, which only arises if they are, is how to account for them. The accounting procedure specified for donated assets is that they 'should be capitalised and include [sic] in the balance sheet at a fair value' (H M Treasury, 1995: 16). Having confirmed that donated assets should be included, there is no further indication of how they should be accounted for, although it is implicit that some form of donated assets reserve account would be needed to maintain the balance sheet's integrity.

The question of depreciation of donated assets is not addressed, but is of significant importance. Arguments in favour of treating depreciation on donated assets as an expense are that this approach facilitates cost comparisons, gives a full measure of service efforts and provides the basis for calculating cost reimbursement. However, Anthony (1989: 64) argues that 'depreciation on contributed capital assets should not affect income' because these assets did not cost the organisation anything. Evidence from elsewhere in the public sector indicates that a single solution has not been adopted; NHS Trusts charge depreciation on donated assets in the income and expenditure account but offset this with an equal transfer from the donated asset reserve, while universities include a depreciation charge, but offset it in the statement of movements on reserve. The existence of such alternatives indicates another area where incorrigible approaches exist, which will have to be resolved by dictat rather than appeal to irrefutable logic.

3.2. Policy Aspects of Depreciation Accounting

The theoretical aspects of depreciation accounting outlined above do not provide an unequivocal conclusion as to whether it is an appropriate policy for government departments where, irrespective of the arguments for and against its use, its implementation is underway. The simple fact of its adoption cannot be used as proof of its relevance; as Burchell et al. (1980: 10) describe the position: 'There is little in the development of accounting as practised that would lead one to describe its essential rationale in terms of the furtherance of economic efficiency or rationality.' However, as noted by Hopwood (1984: 178), 'those with the power to determine what enters into the organisational accounts have the means to articulate and diffuse their values and concerns'. Hence, it is by examining the government's values and concerns that the impetus for its adoption may be found.

From the normative standpoint, depreciation is an imprecise measure of capital asset consumption, but its use can be justified if it conforms with the interests of those causing its application. This provides an explanation, other than the simple dogma of 'private good, public bad' (Parston, 1994) and the contention that 'only by taking a more business-like approach can the government continue to bear down on the cost to the taxpayer' (HMSO, 1994: iii), in that accruals accounting furthers the policy objectives of the government.

A number of benefits consistent with government policy are listed in the Consultation Paper (HMSO, 1994: vii), and are seen as flowing from the adoption of depreciation accounting. These include providing 'more accurate and relevant management information', 'better informed decisions on the balance between current and capital expenditure' and 'promoting the better use of resources', with the possibility of reducing the public sector's call on funds. These represent high expectations from an accounting system which, because of arbitrary allocations and valuations, is unlikely to measure with any precision what it purports to, namely the resources consumed as a result of owning fixed assets with finite lives during an accounting period, and the value of those assets at the end of the period. It is a proxy of consumption value, and those setting the accounting policies expect their objectives to be furthered, as the accounting process has produced 'an answer sufficient for action' (Boulding, 1962: 53) and decision-makers respond to the resulting accounting numbers as if they are accurate.

Moving from cash to accruals accounting is seen in the Consultation Paper as being 'based on principles first laid down in the Financial Management Initiative [FMI] in 1982' (HMSO, 1994: iii). Gray and Jenkins (1993: 59) locate the FMI in the context of seeking 'to promote *accountable management*' and note that, when considering efficiency and effectiveness, there is a 'particular initial emphasis on a range of indicators of both operational achievements and their costs'. The introduction of resource accounting redefines these costs to include capital charges and, by identifying the resources consumed by each departmental aim, facilitates a comparison with alternative ways of achieving the aims, such as using outside contractors. This analysis sees the use of accruals accounting as being consistent with the government's policy of competitive tendering (HMSO, 1994: 7). However, when carrying out comparisons with the private sector or preparing competitive in-house bids, central government departments will have to use full cost based on current values, while any private sector competition can take a longer-term view and use predatory pricing in the short term while reporting the outcome in historical cost, which can be expected to be lower than current cost.

The use of accruals accounting gives economic visibility to features that were previously ignored, and adds a further aspect to those for which managers are accountable. Once stocks of capital assets and their related costs have been identified as matters to be valued and reported, the question arises of how managers are intended to respond. It is clearly the government's intention to exert downward pressure on costs, but it is in the nature of capital charges that they come in large, fixed, indivisible amounts. This restricts the extent of potential managerial control, especially in the short term. The government envisages 'changing the focus of Parliamentary control to voting resources... with the cash implications voted only as a single departmental total' (HMSO, 1995: 14). This emphasises resource consumption as the headline figure, with a consequent possible blurring between its revenue and capital constituents, both of which tend to increase over time. Revenue costs increase because of price rises, but can be mitigated by paying for increases with efficiency gains. Capital costs, even if no extra assets are acquired, will rise as they are adjusted to reflect current valuations, but efficiency gains are not always possible. In the medium to long term, asset restructuring or relocation may be feasible, but this imposes additional transitional costs. Alternatively, costs will fall if assets are revalued downwards, but this does not reflect managerial efficiency; indeed it could result from poor acquisition decisions in the past.

The inclusion of capital assets in the accounts should make managers more aware of their stock of capital assets and encourage them to use them as efficiently as possible (HMSO, 1994: 2). In the examples provided in the White Paper, capital charges are notional and do not result in cash flows, and managers may not feel it necessary to respond to the signals these charges deliver as, in cash terms, there are no consequences. However, Parliament will be providing a fixed amount of resources, and it is possible that growth in the capital element may have to be offset by restricting revenue spending. In the NHS, where capital charges have entered into costs for a number of years, there are now calls to recognise and compensate for their distorting impact, as 'the technical revaluations meant an authority could be paying more for services that have not actually changed' (Day, 1995), and managers are taking decisions in response to them (Heald and Scott, 1996).

4. Unanticipated and unwelcome outcomes

It can be argued that the drive to account for government department results using private sector practices is potentially misguided if the private sector techniques are themselves deficient. A decade ago, Hopper (1986: 11) made a plea for 'a more careful consideration of accounting within the public sector. Otherwise, methods of dubious validity may be imported with unsought consequences upon the public sector's efficiency'. The subsequent decade has witnessed considerable debate about the reliability of accounting in the private sector, and recognition has been given to the 'expectations gap', which exposes the limitations of corporate accounting reports and their failure to convey the reality behind the numbers. These concerns are evidenced in both general commentary (Griffiths, 1986; Smith, 1992) and in specific cases, such as the collapse of Polly Peck (Mitchell and Sikka, 1993: 37).

To treat central government departments as if they are simply private sector entities with a duty to produce accounts that show a 'true and fair view' or 'present fairly' the results, is likely to bring with it all the private sector problems associated with latitude in selecting accounting policies. In the NHS, this has been avoided by being extremely prescriptive. For example, asset lives and revaluation indices are specified centrally. On the other hand, imposing restrictions such as these removes the accounts' ability to reflect local differences. Managers might be instructed to increase the value of buildings by 5%, as this is the national average, but in specific instances this is likely to over or under-state the true position. The choice lies between the possibility of, in all cases, being about right or being precisely wrong, and highlights the contrast between decentralisation of responsibility for activity and the centralisation of the rules for monitoring the activity, with a resulting restriction of local freedom.

If it is accepted that private sector procedures are not perfect, the next question is whether they are superior to current public sector practice. The judges of this are those proposing the introduction, and they are obviously convinced of the expected benefits. While the introduction of revised accounting practices is directly government's responsibility, Mayston (1993: 88) identifies other potential gainers from changes made in the public sector as including 'management consultants, accountants and potential private sector suppliers of public services', and these are likely to constitute a pressure group for reform. This premise is reinforced by examining the list of respondents to the discussion document given in the White Paper, which notes that 'All respondents supported the proposal to implement resource accounting' (HMSO, 1995: 4). There were 35 respondents, including the ASB, five professional accounting and allied bodies, seven accounting firms and the Management Consultancies Association. The financial interests of such groups are likely to benefit from the adoption of accruals accounting: new systems must be established; software and hardware developed and supplied; asset registers created; and training provided. The need felt by these groups to carry their techniques into the public sector may be consistent with the proposition that private sector accounting is itself facing problems and:

> 'that the homeland is on fire, or at least becoming significantly less fertile territory to occupy than in the past, with a consequent need to seek out new lands to take over and absorb. Nomadic behaviour and the search for new territory to occupy may then be the result of short-sighted predatory policies in the homelands rather than of a superior culture' (Mayston, 1993: 89).

The White Paper (HMSO, 1995: 21) states that training will be vital to the reforms' success, and part of this will relate to the underlying concepts as well as the technical aspects. To some degree, the extent to which the concepts are understood is reflected in the technical ability to put them into operation. An indication of the fact that there are deficiencies is contained in the specimen accounting statements in the White Paper (HMSO, 1995: 25–40). The balance sheet relates to the end of the year, but the opening balance sheet is not provided. It is possible, using data from the accompanying notes, to construct the position at the start of the year, and this reveals that whoever prepared and authorised the White Paper did not understand the relationship between working capital movements, costs and cash. The related note indicates that stocks and debtors have increased while creditors have decreased; in fact the opposite is true in all cases. The note also reports an increase during the year in a long-term loan, but there is not any such item in the closing balance sheet. Such errors at this stage imply a worrying lack of expertise on the part of those advocating this method of accounting.

Notwithstanding any theoretical objections, it appears that an accounting system based on accruals will be instituted for government departments and, in these circumstances, attention can be turned to the way the system operates. There is no reason, in the accounting context, why it is not possible to prepare an income and expenditure account rather than an operating cost statement. Elsewhere in the public sector, where accruals accounting exists, the income and expenditure account has been used to match the revenue resources received by the entity with how they have been used, leaving a surplus or deficit. In some cases, the result has been used to assess performance by employing it to calculate the return on capital employed and comparing this with a specified target. Using an income and expenditure account would establish consistency with other parts of the public sector and would also enable a cash flow statement in a more standard format to be prepared, starting with the adjusted income and expenditure account balance.

One consequence of adopting accruals accounting for government departments is that it will provide an indication of the extent of capital maintenance. Even in the absence of an income and expenditure account it is possible to ascertain whether the value of capital has been maintained from the balance sheet. Limited companies are only allowed to make distributions out of profits (HMSO, 1985: Part VIII) or, to put it another way, they must maintain the value of their money capital before any return can be paid to ownership, and the sector's accounting techniques have developed to enable compliance with this rule. While private companies have to maintain the money value of their capital, the valuation rules given in the White Paper maintain an approximation to its replacement value, which is a more stringent condition in times of rising prices. It also presupposes that capital maintenance is necessarily a government objective, or even a feature it would wish to disclose and be monitored by.

Applying the notion of capital maintenance to any part of the public sector brings inter-generational equity into consideration. Identifying a surplus or deficit each year would, over time, enable a conclusion to be reached about whether a government is eroding, enhancing or maintaining the asset base. The government is keen to put downward pressure on public expenditure, and one way to do this is to allow the capital infrastructure to degrade; accruals accounting would reflect this in its reports. A decline in the value of the infrastructure would provide a basis for criticising the government, and it would be difficult to counter charges of neglect since it is using a system that gives 'Better Accounting for the Taxpayer's Money'.

In fact, redrafting the example in the White Paper shows a deficit whereby expenditure exceeds income. This raises the question of how the deficit has been financed and introduces a further feature of accruals accounting; it makes explicit the working capital position and movements in it. It has been possible for departments to use working capital as a buffer against changes in cash allocations, but accruals accounting would reveal the extent to which current expenditure has resulted in increases or decreases in the constituent balances. In the short term, it may be possible to maintain expenditure while reducing central government funding by running down working capital; this enables the government, at crucial times, to appear to maintain expenditure programmes while reducing the cash it needs to collect to pay for them.

Redrafting the cash flow statement in the White Paper to make it more like a private sector one makes it clear that the deficit on the income and expenditure account has been funded by running down debtors and stocks and increasing creditors. Some accounts users, such as pressure groups and opposition parties, may consider that the capital maintenance aspect alone is sufficient justification to introduce accruals accounting, but it is not a potential benefit claimed in the White Paper.

Rutherford (1990: 13) points out that creative accounting exists in the public sector, but the possible extent of this is curtailed in the current proposals by the clearly stated convention that 'Resource accounts should be prepared so as to reflect the economic substance and financial reality of the transactions and activities underlying them, rather than only their formal legal character' (H M Treasury, 1995: 6). This approach, together with accruals accounts prepared in the way indicated above, would also have the effect of removing the possibility of not disclosing 'creative funding' based on policy decisions to enhance or curtail the balances of assets and liabilities carried forward from one period to the next.

5. Conclusion

The production and dissemination of financial information hopefully meets its users' needs; otherwise it is difficult to justify the expense involved. Mayston (1992: 228) recognises users' central role: 'As a normative objective for financial reporting, the meeting of users' needs has now been accepted as the central objective by a long series of reports.' The providers of information also have an interest, explained in positive terms: 'Financial reporting is sometimes better characterised by the phrase *selective financial misrepresentation*' (Revsine, 1991: 17) under which participants in the production and use of financial information are motivated to support approaches that 'selectively misrepresent economic reality when it suits their purpose' (Revsine, 1991: 17). The question of whether the introduction of resource accounting is beneficial can therefore be looked at from the viewpoint of the extent to which it meets both producers' and users' requirements.

Benefits for the government stem from the focus on the stock of capital assets; with this attention should come an end to the idea of such assets being 'free goods'. Therefore, it can be expected that surplus assets will be identified and disposed of to avoid their related charges. This complies with the government's aim of generating cash inflows by the disposal of surplus public sector assets (Bevins, 1994). However, the charges are only notional, and largely outside managers' control. In this climate, additional controls are needed to ensure that disposals and the pursuit of lower costs do not have an unacceptably adverse effect on the services provided.

Changing the basis of measurement may also be advantageous. The resources consumed during the first year reported on the new basis will appear greater than previously, simply because of the inclusion of capital charges. If there is steady upward revaluation, the resources committed annually will also appear to increase as the result of indexation, but this will be at no cash cost. To avoid misunderstanding, the users of the information will have to be aware of the impact of the changes, but lack of financial awareness, especially concerning depreciation, has been found in both the public and private sectors (KPMG Peat Marwick, 1992; Marriott and Mellett, 1994). Problems will arise if managers do not realise how their actions with regard to fixed asset acquisition and disposal translate into accounting measures, and functional fixation has been discerned at times of accounting change (Barnes and Webb, 1986).

The reference to 'taxpayers' in the White Paper's title suggests that they are likely to be users of the reports and benefit from the use of accruals accounting. This can be questioned on two counts. First, the resources being accounted for are those of the entire population. Although the funding comes largely from the taxpayer, the proposed system deals with its disposition once it comes into public ownership. Second, it is a fiction that government resources are in some way owned by the public; once in the public sector, the government is effectively free to do what it likes with them, as exemplified by the privatisation of public corporations. An indication of the interest the public has in the government's financial reports is provided by Likierman and Taylor (1990: 58), who list the sales of the 1990 public expenditure White Paper: 1,644 complete sets were sold and the sales of individual departmental chapters range from 378 to 1,507.

Turning to revenue items, as long as there is adequate disclosure, it will be possible for anyone who is interested to convert the reports provided, with their obscurities whether intended or not, to a more standard set of accounts. The use of expenditure, rather than payments, will reveal the true balance between the inputs and outputs, and show whether any 'expenditure smoothing' is taking place. From the public's viewpoint this is useful information, but might not be what the government had foreseen when advocating the system.

Whether the use of full accruals accounting is better than cash accounting depends on the criteria by which it is judged and who is judging it. The government obviously looks on it as an improvement, as evidenced by the White Paper's title. However, 'better' is a subjective term, and the extent to which accounts based on full accruals are better than their predecessors is debatable; it is clear that they are not 'the best', as they bring with them all the deficiencies of private sector accounts. The whole basis of revaluation and allocation is open to question, but, even if this is overlooked, there is no human, social or environmental dimension.

Finally, taking the title of the project as a whole—'Better Accounting for the Taxpayer's Money'—it may be more accurately described as 'Different accounting for public sector costs, assets and liabilities'.

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ESSAYS IN ACCOUNTING THOUGHT:
A Tribute to W T Baxter

Edited by

Irvine Lapsley

This is a collection of essays compiled to mark the occasion of the 90th birthday of W.T.Baxter, Professor Emeritus at the London School of Economics, and a distinguished contributor to the developement of accounting both as an academic subject and in seeking to influence accounting practice. These essays are drawn from a wide range of contributors, from the academic world and from the world of accounting practice, all of whom address issues which are of importance to present day financial accounting. The topics covered include:

- A conceptual framework for standard-setting; International Accounting Standards; Income measurement and standard-setting; The potential for corrigible accounting; Economic thought in income measurement; Accounting research and accounting practice.

The practice of company financial reporting has been shaped, profoundly, by development in accounting standards in recent years. The topicality of this issue makes it a matter of concern for those members of the accounting profession at the sharp edge of ensuring and maintaining high standards of financial accounting. The importance of these developments highlights their potential interest from the perspective of accounting research. This in itself is a matter upon which W.T.Baxter has reflected and this collection of essays has contributions to the debate on the role (past, present and future) of accounting research and its relationship to accounting practice.

Preface - Sir John Shaw; Irvine Lapsley "Will Baxter - Gentle Revolutionary"; W.T.Baxter "Accounting as an Academic Study"; Geoffrey Whittington "Accounting Standards: A Mixed Blessing?"; Sir David Tweedie "The Conceptual Framework and the Accounting Standards Board"; Sir Bryan Carsberg "The Role and Future Plans of the International Accounting Standards Committee"; John Perrin "Keep Right On, Towards Corrigible Accounting"; John Forker "Income Measurement, Reporting Entities and Share-based Remuneration; Joanne Horton and Richard Macve "The 'Amortized Cost' Basis for Fixed-Interest Investment: A Note on Economic, Actuarial and Accounting Concepts of Value and Income"; Michael Bromwich "Opportunity Cost Revisited"; John Flower "Schmalenbach, Zappa and Limperg: Three "Accounting Heroes" of Continental Europe"; Anthony Hopwood "On Forging an Academic Accounting Community".

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Book Reviews

Foundational Research in Accounting: Professional Memoirs and Beyond. *Richard Mattessich.* Tokyo: Chuo University Press, 1995. Y3090.

It is rare for a book on accounting to make the hairs on the back of one's neck stand up. So I shall never forget the electrifying effect on me, as a tyro academic in the 1970s, of the opening paragraph of *Accounting and Analytical Methods (AAM).* The slight Germanic stiltedness of the writing, far from blunting its impact, seemed rather to intensify it. Mattessich was thenceforward firmly established as one of my intellectual heroes. Hence I was particularly delighted to make the arrangements at Lancaster University for his visit in 1981 on the invitation of Eddie Stamp, and to have the opportunity of meeting Ricco in person and his charming wife Hermi.

Apart from *AAM* and the related paper in *The Accounting Review*, July 1972, 'Methodological problems and preconditions of a general theory of accounting', I suppose that the other component of his voluminous output that has most influenced me is *Instrumental Reasoning and Systems Methodology (IRSM)* (1978). While *AAM* and the *AR* paper are concerned with the methodology of constructing prescriptive accounting theory, *IRSM* marks a move away from issues confined to accounting theory, and into the epistemology of the prescriptive use of bodies of knowledge (instrumental reasoning).

However, Mattessich's interest in accounting theories from a metatheoretical perspective of philosophy of science continued to be manifested in such work as his chapter in *Philosophical Perspectives on Accounting: Essays in Honour of Edward Stamp* (Routledge, 1993), which reflects the ideas of Kuhn, Lakatos, Sneed and Stegmüller, and his latest work *Critique of Accounting: Examination of the Foundations and Normative Structure of an Applied Discipline* (Quorum Books, 1995). It is his abiding concern with the epistemological and ontological issues raised by accounting that led him to choose the somewhat inelegant term 'foundational' to characterise his work.

As he notes on p.78 of *Foundational Research*, Mattessich's work has been less influential than it might have been among accounting academics, because the 'empirical turn' in accounting research (Beaver's 'accounting revolution') deflected interests away from accounting theory development of the a priori type and towards the use of theories and methods from economics and social psychology (and to a lesser degree other social science disciplines) to construct and test sets of empirical hypotheses about accounting phenomena.

The emphasis in this research has been on attempting to improve knowledge of cause and effect relationships (means), rather than on developing the prescriptive theoretical structures (instrumental reasoning) within which means-end relationships for accounting would be set out. By contrast, Mattessich's endeavour has been to formulate what he has come to refer to as Conditional-Normative Accounting Methodology (CoNAM) (for example, in his paper in *Accounting Organizations and Society* (1995)).

The book *Foundational Research in Accounting* is subtitled 'professional memoirs and beyond', but it is some way from being a full intellectual autobiography. Chapters 1 to 4 chart Mattessich's early career from initially qualifying as a mechanical engineer, then becoming attracted to the study of economics and commerce and successfully studying, first for a masters and then for a doctorate, at the Vienna University of Economics. This was achieved when working as an engineer in wartime conditions, and the various difficulties that had to be overcome are both touchingly and amusingly recounted.

Armed with his doctorate, Mattessich embarked on the early years of his career as an academic, first in Switzerland and then in Canada, where, after a period working outside academia, he was appointed in 1953 to a senior position at Mount Allison University. By 1956, he was publishing papers in academic journals which were attracting international attention. This led to his being appointed in 1959 to an associate professorship at Berkeley, where he achieved an international reputation.

Mattessich's intellectual development during these years receives less attention then other autobiographical aspects. However, his attendance in 1955 at the Mathematical Summer Institute of Social Sciences at the University of Michigan appears as a crucial experience which equipped him to write the papers mentioned above.

Chapters 5 and 6 deal with Mattessich's years at Berkeley, including the publication of, and reactions to, *Accounting and Analytical Methods* (*AAM*) (1964). Apart from his abiding interest in the mathematical modelling of accounting structures in conjunction with computing, he cites

C West Churchman as an important intellectual influence. In fact, Mattessich seems to have been intellectually attracted by philosophically-aware economists and operations researchers, and later by philosophers of science, rather than by those working in 'mainstream' accounting or finance research. Perhaps this was one reason why he did not obtain promotion to full professor in the Accounting Division at Berkeley; without using the exact words, Mattessich suggests that in general the reason was that 'his face did not fit'.

The discussion in Chapter 6 of the reactions to *AAM* touches on some of the fundamental features of his thought, and casts some light on the differences between Mattessich and the proponents of the 'new empiricism' in accounting research. Mattessich is concerned with theoretical structures within which accounting prescriptions are expressed as means to ends, conditional on the particular end being pursued, and also subject to certain assumptions (the ability to state the end or purpose being one of those assumptions); the paucity of our knowledge of relevant cause and effect relationships is not regarded as an obstacle. By contrast, the new empirical researchers in the late 1960s were primarily concerned to improve our knowledge of some of the effects of different accounting practices.

Two occurrences during this period indicate that Mattessich's gentle and kindly disposition is far from lacking in toughness. The first was his reaction to his non-promotion at Berkeley: he resolved immediately to seek a full professorship elsewhere. Being a German-speaker, he was sought after for chairs in German-speaking countries, and it was when (as described in Chapter 7) Ruhr University at Bochum appointed him to a chair and then failed to fulfil some of the undertakings it had given him that he again manifested his toughness by resigning and accepting a full professorship at the University of British Columbia.

Thus began in 1967 Mattessich's long and fruitful stay at UBC (he retired and became professor emeritus in 1988), as a member of a faculty that was to include a number of distinguished names and to score highly in international research ratings. Yet a certain hankering after Europe, and more especially the German-speaking lands (where holders of university chairs enjoy high status and appropriate remuneration), persisted. In 1976–78 Mattessich held joint appointments at UBC and the University of Vienna, with the intention of moving to the latter had the university senate not interfered with his plans for setting up a new Institute. True to form, Mattessich met this interference by resigning his post and returning to Vancouver for good. This was also the period of his life when he finished and published *IRSM* (1978).

Nevertheless, the middle chapters of *Foundational Research* (8,9,10 and 11) have relatively little to say about the intellectual effort required to produce a book of such erudition as *IRSM*. By contrast, considerable space is devoted to the Mattessichs' travels. This rather sets the tone for most of the rest of the book, in which international travel features more prominently than intellectual journeys. The visits to Japan (a country much appreciated by Mattessich) resulted in the contacts that led to the commissioning of this book.

Those who had the pleasure of hosting such gracious and delightful guests as the Mattessichs will enjoy being reminded of their visits, and it might seem carping to ask for more intellectual content. But it is a pity that, in recounting his meeting with Mario Bunge, whose philosophy of science has been influential in Mattessich's thinking, he did not explain what it was about Bunge's work, rather than that of other contemporary philosophers, that so attracted him.

The later chapters of the book recount Mattessich's fascination with the work of the archaeologist Denise Schmandt-Besserat on prehistoric record-keeping, as well as his reactions to the book *Twentieth Century Accounting Thinkers* and to the chapter devoted to himself in it, his thoughts on his recent book *Critique of Accounting*, and finally some reflections on his personal beliefs and philosophy.

His reaction to Cheryl McWatters' chapter on him in *Twentieth Century Accounting Thinkers* is worthy of comment. Mattessich is clearly stung by McWatters expressing the opinion that *AAM* 'may not be declared a classic' (and this in spite of the fact that it was reprinted in the Accounting Classics Series). He wonders whether *AAM* has been properly understood even after a quarter of a century, and in particular he feels that his pioneering work on the 'Budget model of the firm' (which was several years ahead of the first commercially available financial modelling software) has been undervalued. Indeed, it is difficult for those who (like myself) first read his book after having used such software for several years, to evaluate its impact in 1964. Certainly, it was not that which made and makes *AAM* an accounting classic for me, but the fascinating and very welcome insights into the epistemological problems of accounting and its theoretical structure.

In his comments on *Critique of Accounting*, he makes a remark when discussing the importance of value-judgements in accounting that is typical of the broad intellectual sweep which has always characterised his work. Referring to the 10-year delay on the part of the medical profession and the pharmaceutical industry in adopting a new, *inexpensive* and highly effective treatment against peptic ulcers, he remarks: 'If vested interests can delay the application of important new discoveries in one of the most progressive sciences, we should not be surprised if such interests can effectively block insights in more modest disciplines such as accounting.'

Mattessich is naturally concerned with the enduring influence his work is likely to have. With the renewed concern for accountability and related issues of corporate governance, the tide in accounting research may be starting to turn away from positivist approaches, and Mattessich's contribution may yet be fully felt.

Those who are interested in the unusual and rich life story of an original and doughty thinker are recommended to buy this book. Those whose interest is primarily in Mattessich's intellectual development will be more drawn to his *Critique of Accounting*.

University of Surrey Simon Archer

Contemporary Issues in Accounting. *Pang Yang Hoong (ed.).* Addison-Wesley, Singapore, 1995. xii+387 pp.

This is an edited collection of 13 papers written as one of the volumes in a 14-volume Singapore Business Development Series. Known as the Communitarian Books Writing Project, initiated by the Nanyang Business School, it was produced in 1995 in time to commemorate Singapore's 30 years of independence. The series was prepared by a joint effort of 184 (mainly Singaporean) scholars of diverse business disciplines.

The book's aim is to provide an institutional and historical perspective to some of the more contemporary issues in accounting. It was writen with the needs of accounting theory students, researchers and professionals in mind. The book is also intended to counteract a dearth of information on Singapore, and wherever feasible, chapters reference issues within the local context.

The first chapter, written by the editor of the papers, provides the framework for the collection. Part I (Chapters 2–4) deals with research in accounting—the schism between academic research and accounting practice, the evolution and nature of market-based research, and the development, relevance and predictive potential of positive accounting theory. Part II (Chapters 5–7) focuses on financial reporting and disclosure issues. The case for accounting regulation, issues determining the amount and relevance of disclosure, and judging information quality are considered in this section.

Part III (Chapters 8–12) is the core of contemporary accounting issues, and covers diverse and complex financial instruments (increasingly important accounting issues not only to Singapore as it develops into a global financial centre), off-balance sheet financing, and in-substance defeasance. It also examines the role of business and accounting in meeting community concerns about social and environmental accountability and disclosures.

The final chapter in this section is a review of the issues and practices underlying consolidation accounting, and also covers translation. Part IV (Chapters 13–14) provides an historical perspective of depreciation accounting and an especially strong and up-to-date chapter on management accounting. This section tries to anticipate accounting's future.

The editor concludes her opening chapter with the observation that because accounting is concerned with measuring and reporting the results of an enterprise's economic endeavour, accounting must of necessity adopt a multi or cross-disciplinary approach to reflect economic reality.

To achieve this, a three-way approach should be adopted: accounting education should take on a more applied perspective and explain to students how current practice differs from best practice; academic research should select problems of relevance to practitioners and accounting policy-setters, and communicate findings in a language that is understandable to them; and members of the accounting profession should adopt a systematic programme of continuing education that includes attendance at academic forums to learn about academic research.

Each of the chapters comprises a synoptical review of the relevant literature, and focuses on the key issues. Exposition is well-balanced, with historical background and contemporary research. Each chapter is refreshingly and clearly written, and concludes with a bibliography. The authors do not labour, like so many modern accounting theory texts, under a morass of accounting pronouncements.

Anyone who has taught accounting theory possesses pet topics and dislikes. As such, one could always argue that the book does not contain chapters on all relevant contemporary issues—for example, post-retirement benefits, stock options, leases, forecasting and accounting for inflation. However, the book makes no pretence that it is exhaustive, as new issues continually emerge to compete for accounting academics' and practitioners' attention.

Adoptees of the book for teaching will probably want to consider whether all chapters are relevant (for example, Chapter 7 might have limited appeal), and whether any chapters warrant treatment over more than one week of a semester (for example, Chapter 14). Taken overall, the size of the book, and the breadth and depth of each chapter's treatment, lends itself favourably to serious consideration as adoptions.

Many accounting theory texts have passed through several editions, and are now laboriously over-written, with key issues 'lost' in the exposition of professional standards and pronouncements. In contrast, this book is fresh, clean, succinct, relevant, interesting, and a worthwhile contribution to the literature. That it claims to be oriented to Singapore's environment is only true in part, and should not be overstated. Less than 25 pages are specific to Singapore (about 6% of the book, and most are in Chapter 7) and in any event are balanced with institutional material pertaining to the US, UK, Australia, New Zealand and other Asian areas.

Regionalism in no way detracts from its utility to educators and students in non-Asian parts of the world, especially as a readings text in a one-semester accounting theory or international accounting course. The book provides clear identification of contemporary research directions and issues in accounting, and will stimulate the reader to think! The book would be especially useful for busy educators who have let their journal reading slip over the past decade.

City University of Hong Kong John K. Courtis

Resources of the Firm: Creating, Controlling and Accounting. *Lennart Nørreklit and Hanns Martin W. Schoenfeld, (eds.).* DJØF Publishing Copenhagen, 1996. 334pp. DKK-340.00.

The authors of this monograph have a praiseworthy aim. It is to introduce a new approach to management accounting and controlling that will permit 'comprehensive resource control'. More explicitly (p. 7): 'To establish a measurement and control system for all resources requires the existence of a clear definition of what constitutes a resource, which of its characteristics (potentialities) are relevant for the firm, how these can be influenced and developed, and how to measure these changes. [But] ... such measures will be insufficient if only quantitative measures are analysed...' Delivery on these intentions would make a seminal contribution to the literature.

There are a number of good things about the book. Its nine papers have a strong unifying thread of a shared school of thought, perhaps because the authors (except Schoenfeld) are all connected with Aalborg University or Aarhus School of Business. The structure is a good one, with the first half comprising three papers on broad issues of resource concepts, choices in accounting systems, and control issues. Best of all, the remaining six papers tackle important areas that are absent from most 'new' treatments of management accounting: markets, ethics, human resources, research and development, information resources and strategy.

However, the detailed content often disappoints. The opening view of a firm's resources (Lennart Nørreklit) gives a curious mix of philosophical jargon (such as 'The transitivity problem in constructing coherence'), banalities ('A chain is no stronger than its weakest link') and algebraic formulations that seem to have no serious applications. Page 34 states baldly that five basic resources of the firm are managers, employees, customers/markets, technology and finance; these are later joined by information systems and development resources such as R&D (p. 49), but not until p. 52 is there a very broad definition of what is intended by a resource. The frequency of typographical errors is the last straw.

The second paper, by Schoenfeld, is much better. It gives a wide-ranging review of costing approaches and argues for the extension of analyses both over time horizons and over dimensions that cut across financial accounting requirements. The abstract to this paper admits 'the ideas are not new', but the author does make a good case for an extension of measurement methods. The last of the overview papers (by Hanne Nørreklit) presents 'a framework for resource control'. It makes much of 'coherence' (so that 'Coherence exists when there is no non-coherence', p. 124), briefly considers a number of tools such as gap analysis and gives a whole page to performance evaluation.

The papers that focus on specific areas start with 'Managing market resources' (Andersen). This emphasises the 'long-natured and stable' character of business relations, supported by three brief case studies of Danish companies. Towards the end there is a very general section on 'market resources as investments', but no hint of issues such as recent uses of management accounting for brands.

The case study mode continues with the vice-president of a Danish savings bank explaining his bank's approach to 'Resource accounting and the ethical statement' (Gammelgaard), involving a large annual telephone survey of stakeholder opinions. The author frankly sees the purpose as increased long-run profits, so that for 'ethics' read 'public relations'. Nevertheless, the approach is promising as a tool for countering management short-termism.

Another tool for countering short-termism that was promising three decades ago is the subject of Koefed's paper on 'Human resource accounting'. There is an inevitable feeling of déjà vu, but Koefed concedes that the HRA literature has languished recently and offers a capable summary of past proposals with some hopes for the future.

R&D, central to corporate strategy, is strangely ignored by those who currently advance ideas of strategic management accounting. So 'Accounting for R&D' by Israelsen and Jensen is a welcome contribution. They describe a 'generic chain' of R&D activities, involving a series of measurement points at different stages of the activities. This is well-suited to the serial nature of R&D. Less convincing are some naïve uses of NPV (e.g., p. 259) and a view of first-stage R&D as a boffin's 'black box' (p. 256), which runs counter to evidence that

R&D can benefit from early marketing involvement.

The following paper by Johannsen and Reinbacher tackles another weighty topic, that of information as a resource. It starts by claiming that 'During the last 10–15 years it has been widely accepted that information is a corporate resource...', which begs the question of what generations of entrepreneurs have been doing since medieval Italian merchants adopted bookkeeping. Information as a competitive advantage gets such short shrift that 'information does not diminish when it is consumed...[but]...has a self-multiplicative quality...' (p. 287). This is another paper that gives much space to matters of definition; it also summarises material from a number of writers, notably Porter, but adds little of its own.

The final paper by Vante considers strategy in a resource perspective. The hope that this might offer an analytical framework for corporate strategy is soon dashed. Despite references to the strategy literature, it returns full circle to the Nørreklit themes of coherent resources, transitivity and unconvincing algebraic formulations. Its blandness is epitomised by a sentence on the penultimate page: 'In reality, a single resource is not used alone, but in combination with one or more resources' (p. 328).

This book raises interesting issues. Some of the papers deal with their topics effectively, but others are far less successful, Nevertheless, the book does a service by highlighting important matters that are relatively neglected in management accounting. Perhaps this initiative will encourage others to continue with these themes.

University of Bristol Don Egginton

Management Control in a Voluntary Organisation: Accounting and Accountants in Organisational Context

P. Booth. Garland Publishing (New York and London, 1995). 279pp. £35.50.

A quick review of the extensive bibliography of this book confirmed what I had suspected as I read its opening paragraphs and began to think about how best to comment on it. This is one of the first, if not the first, full-length study of accounting in action, ie, a work informed by almost two decades of what some have referred to as the new accounting research, even critical accounting research. As such, it carries the heavy burden of responsibility for demonstrating what those of us who are committed to this sort of accounting research are able to offer that is crucially absent from more mainstream, technically-oriented, even functionalist approaches.

The study itself is of the role that accounting, principally in the form of management accounting and control systems, played in a division, the Northern Division, of a major Protestant church in Australia (the Mainstream Church) in the later 1980s. A description of the Northern Division forms part of the third chapter of the text, together with a discussion of the case study design. The data for the study are derived from three principal sources: observation, with the author assuming the role of observer as participant; semi-structured interviews; and from a range of documentary materials, some of which are detailed in a supplement to the bibliography. Brief reference is also made in the chapter summary to the question of what generalisations can be made from the case study findings.

Chapter 1 provides the 'background and rationale' for the study. It situates the book in the relevant research literatures, discusses some of the issues associated with a case study of a voluntary organisation, and provides a summary of the principal empirical findings to be reported in subsequent chapters. Finally, there is a chapter summary, something repeated throughout the rest of the book, except in the conclusion, Chapter 7.

The second chapter is essentially a wide-ranging literature review from which the author derives his chosen conceptual/analytical framework, termed 'critical structuralist'. Peter Armstrong's seminal work on accounting controls forms the basis for this framework, enhanced by a number of contributions from the hitherto less influential neo-institutional perspective of organisational analysis. In the chapter's concluding paragraphs, three interrelated propositions are identified as informing the subsequent analysis of the significance of accounting in churches (p. 71). These refer to the consequences that a general process of rationalisation, and a tendency toward secular crises with a strong financial dimension, will have on the conflict which (inevitably) exists between accountants and sacred occupational groups within churches.

The greater part of the book is devoted to the analysis of the accounting systems in operation in the Northern Division. Chapter 4 is divided into two parts. The first is concerned with the general or formal character of the management accounting control system, the main accounting reporting system for the administrative infrastructure, and the budgeting system that integrates the various departments' activities within the Division along a financial dimension. The Northern Division's financial fortunes since 1977 are the subject of the second part of the chapter.

Chapter 5 outlines the significance currently afforded to accounting by the accountants and by the various sacred groups in the Division. Significance is determined by considering both the extent to which accounting information is used, and perhaps more importantly, the purposes it is used for. The general conclusion is that, presently, accounting has a variable significance within the Division. Chapter 6 focuses on the principal site for conflict between the two groups—the budgeting process itself. The first part of the chapter returns to the deteriorating financial situation within Northern Division since 1977, and its implications for budgeting. These are analysed in organisational and behavioural terms, attention being drawn to various continuities and discontinuities over time. The dynamics of the 1988 budgeting process are discussed in the second part of the chapter, the outcome of which was 'significant reductions to the mission activities of the sacred departments' (pp. 215-6). For Booth this outcome signalled a likely future of increased significance for accountants and their controls within the Division.

I found this to be a seriously overwritten book; not a pleasing read. A major reason for this was the very tight structure evident throughout the text, a structure reflecting the fact that this is essentially the author's doctoral work. It would not have been too difficult to have removed the interminable summaries, reduce the length by about a third and let what is clearly an interesting story unfold.

A second concern is that, despite the author's claims, there is very little integration of his theoretical framework and the empirical materials. Again, part of the problem is that in doctoral work demonstration of a command of the literature is required. I suspect that it would have been possible to write up this case study with a much slimmed-down Chapter 2. Finally, on a more substantive point, I am not persuaded by the critical structuralist framework as it is developed in this chapter. I don't recognise the label, and while I can see how it is entirely possible to describe Armstrong's work as both critical and structuralist, the neo-institutionalism embraced to enhance it is neither of these things, at least not as I would understand the terms to mean. Moreover, if you are attempting to understand accounting in action, isn't it desirable to borrow from the constructionist tradition in some measure?

My evaluation of this book is that the author 'could do better' in demonstrating the contribution of the sort of approaches to accounting research that both he and I so clearly value. However, I feel it is important to add that the publishers must bear some of the responsibility. In the past, Garland has made a significant contribution to advancing accounting scholarship by publishing doctoral work of this sort. Now that we have high standards evident across much of the literature, it is a little disappointing to find that they apparently feel little need to review their own editorial procedures.

University of Stirling Robin Roslender

Managerial Uses of Accounting Information. *Joel Demski.* Kluwer Academic Publishers, 1994. 655pp. $140.50.

Recently, a host of new texts on managerial accounting have arrived on the scene, claiming greater relevance with increased coverage of real world business cases, and providing a host of supplementary teaching aids. These texts seem to be encouraging UK educators to abandon the traditional diet of presenting a mix of classic and recently published research papers in organisational and economics-based managerial accounting research. In my view, these 'new' types of texts can play a useful part in introductory courses, where students have little experience of basic management accounting practice. However, Joel Demski's book comes as a timely reminder that the study of management accounting neither is, nor should be, portrayed as a simple mechanistic subject with established 'real world' solutions that robustly apply across many organisations.

It is apparently with the intention of motivating students to develop thoughtfully and apply structured logical questioning skills, rather than rote learning, that the author has written this text. In later life when students move into practice, much work will be required to understand when and how to question the host of practices they will observe in organisations. Thus this text aims to provide a general preparation for the student embarking on this odyssey. The text adopts a comprehensive, ordered approach, and as a result the reader who chooses to skim through the text, looking for essential points, may find they are somewhat disappointed. However, as the author makes clear, the text is not designed for such readers. A more patient, thoughtful, approach is required to get the most from it.

As to be expected from this author, the text provides comprehensive coverage of managerial agency theory. However, it should be noted that before introducing this subject, the student is exposed to a thorough coverage of traditional foundational topics such as product costing and managerial decision-making from a micro-economics-based perspective; thus the text can be used as the basis for a complete course of instruction. Throughout, the author stresses what he calls the accounting library principle. This is intended to motivate the student to understand the flexibility that is possible when structuring managerial reports, and thus encouraging the student to think 'why' rather than 'how' to produce a standardised report.

With regret, I note that some UK instructors, having chosen to expose students to foundational topics in introductory courses, may not have the time to cover the whole text, preferring to concentrate in an intermediate course only on the agency contracting (incentives) material of this text. Since I perceive this to be quite a common constraint faced by UK instructors, I believe it would have been useful if the author had provided a brief summary discussion of the earlier sections aimed at those who wished to 'break into' the text at this intermediate point.

Turning now to possible student responses to the material, it is my experience that in general students find published research in managerial agency theory difficult to read. This is usually the result of the level of abstraction favoured by some authors. The author addresses this issue by guiding the reader through many of the established ideas via simple, discrete, worked examples. Indeed, the mathematical requirements of the text are more than covered by the standard accredited quantitative methods course presented to UK accounting students, and hence mathematical prerequisites should not act as a barrier to following this text.

However, as the author clearly identifies, the study of agency theory is always likely to be notation-intensive; hence students need to be made aware of the requirement to become familiar with notation. This does not seem to me to be an unreasonable request, provided consistent notation is used throughout a course of instruction. Thus, if an instructor wishes to supplement the book with additional material, then a consistent notation guide should be provided. In my view, trying to spread this notational set-up cost over too few lectures is often the reason why some courses in this area encounter negative student responses, that is, students need to be given sufficient time to 'digest' the notation.

Another difficulty experienced by some students is that they find it hard to understand how microeconomic models of accounting problems are developed. This is illustrated by the following question I am sometimes asked: 'Given the host of detail that we could use to describe actual organisations, why does the modeller choose these ones?' In this respect, the author's development of various models is well-presented, with clear intuition. I would, however, have liked to see an introductory chapter on how economic models of accounting phenomena are constructed, taking into consideration modelling issues such as tractability and the construction of refutable hypotheses. This could be used to ease the student into understanding the stylised way this approach poses managerial accounting problems.

As the text develops and models become more sophisticated, the author introduces stylised real world examples, often located in the problems and exercises subsections. I enjoyed the author's sometimes witty choice of examples, such as his brief discussion of the non-financial performance measures used by clerics during Medieval times. Not surprisingly, however, most of the examples are drawn from a US context. A somewhat demanding task for the UK instructor is to decide whether to supplement these examples with additional material on contracting practices elsewhere. For instance, in my course at the London School of Economics, I use Mari Sako's book on Japanese contracting practices (*Prices, Quality and Trust*, Cambridge University Press, 1992) to illustrate how 'arm's length' (agency) contracting practices are only one way of structuring incentive contracts. Indeed, the point needs to be made to students that the obligational form of reputation-based contracting used in Japan, and sometimes in Europe, is also amenable to the type of systematic economic analysis that the author applies to more US influenced practices. In this respect, I feel that the author's introduction of the incomplete contracting approach, only in the last few pages of the book, may be too late for some readers. I personally would have found an earlier presentation of a taxonomy of contracting practices helpful in providing students with an appreciation of the wide range of contracting possibilities available. However, I recognise that this may add too much additional complication to the text.

There is much to recommend this text. It tries to develop and encourage students to adopt a structured, thoughtful approach to managerial accounting rather than a simple checklist mentality. Subject to the following caveat, I would be happy to make this text the essential reading for my intermediate students, as it is an accessible and well-motivated textbook. There now exists little excuse for UK instructors not to expose students to the modelling methods and insights of agency theory.

However, my caveat to this recommendation is that before embarking on presenting a course based on this text, instructors should perhaps test their comprehension of the subject by trying to understand the pricing policy adopted by the publisher!

London School of Economics and Copenhagen
Business School Miles Gietzmann

Accounting and Business Research

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Tel: 01524 593977. Fax: 01524 594334. E-mail: k.peasnell@lancaster.ac.uk

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Depreciation Need Not Be Arbitrary

John Lane and Roger Willett*

Abstract—Following Thomas (1969, 1974) the depreciation adjustment charged against accounting earnings is nowadays commonly presumed to be entirely arbitrary when it is viewed from a measurement perspective. This paper develops a statistical interpretation of accounting measurement to show that the depreciation calculation need not necessarily be viewed as incorrigible in Thomas's sense. A probability modelling approach is adopted to illustrate how the depreciation adjustment can be used to smooth accounting earnings over time. Depreciation is thus shown to have potentially useful estimation properties. The results have obvious policy implications regarding the objectives that depreciation and other accounting allocations might serve. They also have a bearing on fundamental questions regarding the nature of accounting measurement.

1. Introduction

This article uses a probability modelling technique to analyse certain *theoretical* conditions under which the accountants' depreciation adjustment 'smooths' accounting income. In a specific case a depreciation formula is derived that minimises the variance of an earnings stream around its long-term per period average.[1] Although only an illustration of a more general thesis, this demonstrates that the practice of depreciation accounting need not be entirely arbitrary in the sense of Thomas (1969), but may be designed to achieve a definite statistical objective, in this instance that of providing a relatively efficient estimator of long-run profitability.[2]

The approach taken to modelling here is based on the transactions idea that accounting numbers are produced by the matching of revenues with expenses in activities (Littleton, 1953). This is significant to understanding the ensuing developments because income measurement is usually nowadays analysed through the alternative 'balance sheet oriented' approach based on Hicks (1946), which is founded on the neo-classical economic theory of value. Thus the ability of the modelling system described below to generate new results and insights into the nature of accounting measurement provides some justification for the belief that we should return to the more traditional 'transactions' interpretation of accounting measurement.[3]

There are several specific issues in accounting theory and practice for which this approach has relevance. Two of the most central are the allocation problem and income smoothing. Both are intimately connected with the estimation approach to understanding the purpose of accounting measurements. The essential idea is to interpret depreciation as a statistical method of averaging activity costs with respect to time, so that any earnings number incorporating a depreciation adjustment may be designed to be a less volatile estimator of the profitability of activities over a longer period

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*The authors are, respectively, at the University of Wales, Aberystwyth, and the University of Otago, New Zealand. Correspondence should be addressed to Professor Willett, Department of Accountancy, University of Otago, PO Box 56, Dunedin, New Zealand. This paper was submitted in May 1994 and accepted in November 1996.

[1] Equivalently (in a sense that is explained later) it minimises the variance of earnings around the long-term average cash flow. The term 'earnings' refers to profit and loss *after* depreciation. Profit or loss *before* depreciation will be referred to as 'undepreciated earnings'.

[2] It should be emphasised that the analysis carried out here is *not* an argument in favour of using long-run profitability as a performance measure, or even one advocating the use of the minimum variance criteria in estimation. These concepts are chosen to illustrate a much more general thesis, namely that accounting numbers are specialised statistics, the properties of which it is open to us to investigate through a precise description of accounting practices. Long-term profitability is used as an example of a parameter that could possibly be of interest to a decision-maker. The analysis could be repeated using, for instance, net present value, although in that case at least one additional variable (i.e., the interest rate) would need to be modelled.

[3] It is important to appreciate that the theory described here is one of measurement, not of disclosure. Thus, to whom a measurement is reported is not explicitly considered, although instances might be suggested to motivate the analysis. The theory is concerned with some of the statistical properties of the depreciation calculation, whether or not the results of the calculation are actually reported to anyone. This is analogous to asking the question in statistical theory: 'What are the statistical properties of the arithmetic mean?' without considering who might use that information. We know, for example, that the arithmetic mean has the property of smoothing the variables that are averaged. This paper examines the smoothing properties of the depreciation adjustment when it is also interpreted as an averaging device. To our knowledge, this important issue has not been explicitly considered before in a purely analytic context.

of time than it would be in the absence of a depreciation adjustment.

The contribution of this paper to a better understanding of these matters is that the underlying formulation of the modelling process is precise, being founded on a rigorous axiomatic theory of the accounting measurement process, and the estimation thesis is developed in a more general context than has previously been the case. Furthermore, the method used for analysing accounting adjustments' smoothing properties allows the possibility of a more active, less passive role for the accountant. Instead of asking if and why depreciation practices are used, it becomes once again sensible to ask whether a particular pattern of charging depreciation may be best for some purposes.

In the next section, the literature concerning the issues just mentioned is discussed in more detail. Section 3 then motivates the analysis with a single asset, single product, finite life example. Section 4 generalises the treatment in the context of uncertainty, and Section 5 concludes.

2. Relevant literature

The modelling approach applied in this paper is based on a theory of accounting measurement described in Willett (1987, 1988 and 1991), which was designed to avoid Thomas's *allocation* problem and McKeown (1972) and Vickrey's (1978) related *aggregation* problem. The latter problem was dealt with in Hodgson et al. (1993) and the analysis here concerns the allocation problem. In the approach taken, estimation theory (Brief and Owen, 1970) comes into play and, by the nature of the depreciation problem's formulation, the smoothing literature is also relevant. These areas of the accounting literature will now be discussed in more detail.[4]

Depreciation has traditionally been viewed as a measure of the fall in value of a fixed asset through its use in production, the passage of time or technological or market changes (e.g., ASC, 1987, para. 10). This is a view that has become a standard rationalisation of the depreciation adjustment by professionals in Anglo-American countries (e.g., FASB, 1980). At first glance a plausible viewpoint, it does however lead to apparently insurmountable difficulties in providing a sound measurement framework from which to choose among alternative depreciation policies. This fact was suspected by a number of writers before it was given a more formal statement by Thomas (1969).

According to Thomas, the conventional approach to depreciation involves attempting to find a non-arbitrary, unambiguous and precise method of allocation that achieves the goal of 'matching' all revenues to all inputs, and which faithfully represents the empirical attributes of the underlying process which bring about such an outcome. By a careful process of reviewing arguments of this sort in the literature, Thomas effectively demonstrated that it was unlikely that any such non-arbitrary allocation method would ever be discovered that satisfied both these objectives.

The conclusion typically drawn from Thomas's arguments is that accounting depreciation is an inherently arbitrary 'measure' in the sense that it has no empirical reference point in the real world. Thomas himself favoured recording changes in market values in lieu of depreciation charges. However, this position failed to win much support in practice and his theory led, in the academic literature, to a search for a rationale for depreciation accounting in disclosure practices and, more specifically, to explanations for particular depreciation strategies on the basis of their effect on organisational behaviour.[5] While such explanations are undoubtedly pertinent to understanding the choice of depreciation method used in practice, however, they have directed attention away from the important possibility that certain depreciation practices might be better than others for some statistical purpose, assuming the concepts of 'better' and 'purpose' can be precisely defined in an appropriate context.

Such a possibility becomes more certain if Thomas's conclusion, above, was invalid. There are, in fact, at least two other conclusions that could just as easily be drawn from Thomas's analysis of accounting allocations. One is that his theory is an accurate representation of accounting measurement's function, but nobody has yet been able to suggest the appropriate empirical process that is modelled by depreciation. Another possible conclusion is that Thomas's theory is *not* an accurate model of the accounting measurement process.

There is a simple observation that can be made in this regard which has been noted before by other writers[6] and goes directly to the heart of Thomas's analysis. It suggests that the second of these alternative conclusions is, in fact, the more likely. The observation is that the revenues from output are determined by a very long list of factors (including the laws of demand and supply) in addition to the costs of the inputs. Consequently, if the tracing of the causes of changes in monetary revenues to physical inputs really is the chief function of accounting, the direct and indirect effect of all these many additional factors (most of which exist outside the firm's control) would need to be fully accounted for if an analysis of the type demanded by Thomas was to be successful. Given the complexity of the economic environment, it seems unlikely that this task will ever be carried out in a convincing manner. Everything 'interacts' with everything else, as Thomas pointed out. Therefore, one has to ask the question: is there a plausible, alternative characterisation of the income calculation that does not lead to the conclusion that all depreciation methods must be arbitrary? Furthermore, if such a characterisation exists, does it give the depreciation methods used in practice a logically consistent and empirically meaningful rationale? The modelling technique described in the following sections of this paper claims to do just this.

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[4] Space does not permit discussion of the many other related topics such as income theory and the predictive ability of earnings upon which this analysis impinges.

[5] For example, in the analysis of the role of allocation methods in achieving organisational goals (e.g., Hughes and Schiener, 1980; Hamlen, Hamlen and Tschirhart, 1977; Jensen, 1977) and more recently in positivist attempts to relate depreciation practice to economic variables such as gearing levels, through agency theory arguments.

[6] This is basically the same point as that made by Hendriksen (1983) in the observation that one of the seemingly insurmountable problems faced by theories of current value accounting is the attribution of changes in the values of assets to the activities of the firm.

Probably the most obvious source of inspiration for the modelling approach used here, apart from Littleton's (1953) transactions theory, is the estimation theory of Brief and Owen (1970, 1973). A similar viewpoint is adopted, namely that accounting numbers such as earnings should be looked on as sample statistics drawn from an accounting period that can be utilised to make inferences about the underlying economic processes affecting a firm's well-being over some longer decision horizon. However, there are a number of significant differences from the earlier approach. First, the thesis is broader: accounting calculations are interpreted as statistics, but estimation, while a useful illustration of the thesis, is only one of its aspects, not its raison d'etre. Second, the focus of attention is on accounting numbers themselves (e.g., earnings) rather than on ratios (e.g., the return on sales). Third, the underlying structure on which the analysis is built is entirely different from the intuitive conception of the accounting process assumed by Brief and Owen. Indeed, the latter seem to have implicitly accepted Thomas's interpretation of the incorrigibility of single asset analysis in the multi-asset firm (Brief and Owen, 1973: 5–6). This dependence on Thomas's theory leads to overly restrictive conclusions about the import of their analysis for the role of allocations in accounting measurement. Consequently, with the different approach to accounting measurement discussed in the next section, it is possible to resurrect Brief and Owen's thesis free of the charge that it is founded on incorrigible practices.[7]

It is worth mentioning, in this context, a paper published some years ago by Ijiri and Kaplan (1969) which is in some ways a precursor to the modelling approach described below. That paper sought, like the present one, to address the issue of the proper form of depreciation from an analytic perspective. Ijiri and Kaplan's definition of depreciation as acquisition cost less salvage value written off over an asset's service life is quite close in spirit to the present analysis. The idea was that asset lives should be treated as random variables, and the proper pattern of depreciation could be derived by weighting different possible depreciation schedules by the expected life of the asset concerned. However, their analysis was set in the context of depreciation being an attempt to associate falls in asset values with accounting periods, and thus ran into the deep problems of interpretation identified by Thomas.

This was an unnecessary association from the point of view of advancing the thesis that accounting numbers are special types of statistics and, together with the influence of Thomas's theory on the accounting literature, it had the unfortunate effect of stifling what could have been a promising avenue of investigation into the properties of the depreciation calculation. The modelling procedure described in the next two sections may thus be viewed as a systematic extension of Ijiri and Kaplan's (1969) original idea, as well as being a generalisation of the Brief and Owen (1973) thesis.

Given the focus on using depreciation to reduce the volatility of earnings, there is clearly a sense in which the theme of this paper is also related to the issue of income smoothing. The selection of measurement rules to reduce variations about trends in income was the basis of Copeland's (1968) definition of artificial income smoothing. In a comprehensive view of the income smoothing literature, Ronen and Sadan (1981) classified its components under four main headings: the *objectives* of smoothing (the economic motivation for smoothing practices); the *object* of smoothing (the variable that is smoothed); the *dimension* of smoothing (the means by which smoothing is accomplished); and the *instruments* of smoothing (the device or technique by which smoothing is accomplished). In terms of this classification, the analysis reported below focuses on the 'object' of income, investigating allocation over the time 'dimension' of smoothing by way of the 'instrument' of depreciation. Apart from statistical objectives (in this case to provide good estimators), nothing of any substance is asserted concerning the economic motivation explaining why accountants might want to smooth the income figure.[8]

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[7] 'Incorrigibility' is the more specific term that Thomas used to describe what he meant by 'arbitrary'. Unless one specifies statistical criteria (such as a quadratic loss function for decision-makers), the choice of a statistic to estimate a parameter may in a sense be 'arbitrary'. Thomas's meaning of 'arbitrary' was much stronger than this. 'Incorrigibility' means 'represents nothing existing in the real world'. The message of this paper is that a depreciation calculation, interpreted as an estimator of something, need not be 'arbitrary' in the stronger sense used by Thomas.

In the latter respect, and in the fact that it is analytic, the smoothing technique explained below is quite different from the focus of the earlier income-smoothing literature. Most earlier work was empirical and it was explicitly and even predominantly concerned with the motivation underlying smoothing practices. Furthermore, it emphasised the relevance of smoothing phenomena to financial reporting as opposed, for instance, to management accounting issues.

Ronen and Sadan's viewpoint, which probably even now reflects the conventional wisdom of North American academics on these matters, was based on a decision-theoretic, contracting framework in which it was assumed that income smoothing is equivalent to the signalling of useful information by management to users. The theory was set explicitly in the context of the theory of efficient capital markets, and they attempted to test for the existence of actual smoothing behaviour by an empirical study. The results from this type of research to date have been inconclusive, and the extent to which smoothing behaviour takes place in practice is still not clear. In contrast to earlier smoothing studies, the question addressed in this paper does not ask what might motivate managers of publicly-owned firms operating in an efficient capital market to smooth income numbers, or what might motivate preparers more generally to adopt smoothing behaviour. It does not even ask the basic empirical question of whether smoothing behaviour takes place, successfully or unsuccessfully, in practice. It simply asks the question: 'Given an effective description of the earnings calculation, is there a purely technical solution to finding a form of the depreciation adjustment which best smooths that calculation over time?' This question is non-trivial. Attempts to smooth may be counter-productive. They may actually make the income number more variable.[9] The analysis reported below demonstrates, however, that for at least some models there is a precise answer to this question and that, by implication, the same basic approach could be used to investigate alternative scenarios.

Finally, it is worth distinguishing this analysis from a number of theoretical papers circulating recently in both published or unpublished form, which either explicitly or implicitly deal with the effect of allocations on accounting income as a basis for valuing the firm. Two will be mentioned: Feltham and Ohlson (1996) and Demski and Sappington (1990). These approach the notion of income in a manner which is typical in the re-emerging literature on fundamentals (see Penman, 1992), and they stand in contrast to the essentially different approach taken to modelling accounting earnings in this paper. Both take an economic theory viewpoint similar to that alluded to earlier in the context of Thomas's model of accounting measurement[10], and Demski and Sappington (1990) additionally endeavour to reconcile this with an information theory perspective.

The specific purpose of Feltham and Ohlson (1996) was to generalise the 'solution' to the question of 'what is an appropriate depreciation "expense" using present value techniques?' from extremely artificial theoretical conditions, including strict certainty assumptions, to the less artificial conditions of uncertainty. Demski and Sappington's (1990) theory of 'fully revealing' income systems similarly incorporated the concept of economic depreciation in its definition of income (i.e., through the changes in asset value component of the model). Both papers sought an understanding of the meaning of accounting earnings and its 'permanent' component through discounted cash flow concepts. The still very restrictive conditions assumed by both approaches make these theories very difficult to interpret in practical circumstances. In this respect, and specifically in their reliance on assumptions concerning the structure of markets, rational decision-making and information about future states for the validity of key properties of their fundamental measurements (e.g., the additivity of values), they differ profoundly from the theoretical approach adopted here.

3. Motivation for the approach

The motivation for the approach to the analysis of the optimal depreciation charge described in the next section may be explained in the context of the following very simple, deterministic example. Suppose a fixed asset is purchased at the beginning of accounting period 1 for £6 and sold at the end of accounting period 2 for £2. Also, suppose that the single product produced by the machine nets a contribution margin (i.e., sales revenues less input expenses for materials, energy and labour) of £5 in each accounting period. The question then arises, is there a 'correct' income figure that somehow directly captures the essence of how well the firm in this illustration has performed?

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[8] Formally, the user of the relevant estimator is assumed to have a quadratic loss function. The effect of differing loss functions on the choice of estimator is an interesting and important question, particularly in the context of accounting measurement, which could be addressed using the modelling approach described in this paper. However, it is a potentially vast topic and is not dealt with here.

[9] For example, in the simple analytic model considered in Willett (1991), if the accountant's guess at the residual value of the fixed asset exceeds twice the true expected value, the variance of depreciated earnings becomes greater than that of its undepreciated counterpart.

[10] Feltham and Ohlson (1993), for instance, refer to '...the measurement of depreciation expense as a cost allocation procedure that matches the cost of the investment with the flow of benefits it produces' (p.1).

Given the amount of time devoted to this question by income theorists without reaching any agreement, the answer is presumably negative. The difficulty originates in the assumption that an annual earnings figure based on the matching of revenues and expenses represents a directly observable attribute of the firm. In the illustration the total profit of £6 (i.e., £[5+5 − (6 − 2)] over the two periods *is* directly observable, in the sense that documentary evidence of the sales and purchases may be checked and agreed on by anybody with access to the appropriate information. However, there is no corresponding direct measure of the profitability in each period, i.e. earnings is not a fundamental measurement. Depending on how the cost of the fixed asset is treated in period 1, there are an infinite number of possible alternatives for dividing earnings between the two periods. For example, if the fixed asset expenditure is treated on a 'cash' or 'funds flow' basis, the time pattern of earnings is a loss of £1 in period 1 and a profit of £7 in period 2. If expenditure is recognised on completion of activities (i.e., undepreciated earnings), the profit is £5 in period 1 and £1 in period 2. Obviously there are an indefinite number of alternatives. A further question therefore arises: since there appears to be no 'true' income figure, is there perhaps a 'best' income figure that can be chosen from among these alternatives?

The need to find an answer to this question is essentially the reason for interpreting annual earnings as a statistic (that is, as a function of the data available to the accountant). In estimation theory, one has to specify a parameter to be estimated and criteria by which to choose the best estimator. Both these choices are open to rational debate and so in a very weak sense are arbitrary but are not incorrigible in Thomas's sense of the word. For instance, if it were desired to estimate the objectively identifiable profit per period of £3 (£6/2) in the illustration, an earnings figure of £3 in both periods would be the best estimator. This, of course, is exactly what one would get if depreciation was charged on a straight-line basis using the actual realised value and life of the fixed asset

$$\left(i.e.,\ \pounds 5 - \left(\frac{\pounds 6 - \pounds 2}{2}\right)\right).[11]$$

Evidently the numbers used in the example are contrived. It is not generally true that charging depreciation in this way, or charging depreciation at all, will *always* provide best estimates of a performance parameter such as that chosen above. However, the example illustrates the potential of a statistical interpretation of the depreciation calculation in particular, and earnings numbers in general, to provide a rational basis for choice between competing alternatives.[12]

The earnings figure in an income statement is the result of aggregating a long list of revenues and expenses recorded in many different accounts. Simplifying accounting practices somewhat,[13] the manner in which these accounts contribute to the overall earnings figure varies according to which of three main types of activity they record. First, there are straightforward 'expense' accounts that are charged against revenues as costs are incurred (as is the case with expenditure on office salaries, and other 'overhead costs'). Second, there are 'current asset expense' accounts, the balances of which are carried forward in the balance sheet until a sale, against which the asset is 'matched', takes place (as with inventories). Finally, there are 'fixed asset expense' accounts, the balances of which are carried forward, as with current asset expense accounts, but a charge for depreciation may be made against earnings, with an adjustment for profit or loss being made in the period in which a sale takes place (as in the case of plant, machinery and motor vehicles etc.).

Thus the value attaching to an account in an income statement can be seen to depend, in an essential way, not only on the costs incurred in activities, but also on the dates on which activities begin and finish and, in the case of the fixed asset accounts that are the focus of the analysis in the next section, on estimates of residual values and expected lives. If, therefore, the proposition is accepted that the numbers recorded in these accounts are ultimately random variables generated by economic processes with random start and duration times as well as random costs, it is easy to appreciate that the earnings figure, formed as a sum of the accounts, is also itself a random variable.[14] Furthermore, it is also clear that the variance of earnings depends on the variance of the costs contributed by the individual accounts, and possibly their covariances if these are not zero. Given that the estimates of residual values and expected lives entering into the valuation of fixed asset accounts are discretionary elements in this process, the depreciation adjustment is an obvious candidate for possible use as a smoothing device for any of the various objectives discussed in the previous section.

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[11] Average per unit of time profitability is just one possibility for choice of decision parameter to be estimated. This analysis could be redone using other parameters—for instance those in which the time value of money is a factor. The motivation for choosing periodic average profitability at all, apart from that it is easy to relate to directly measurable quantities, lies in the simple basis it provides for ranking investment opportunities. Other things being equal, a set of activities with a high per period profit should provide a better investment opportunity than a set with a low per period profit. Consequently, accurate estimates of periodic profitability via the earnings figure could be of general usefulness, and using depreciation to reduce the variance of such estimators would increase their accuracy in the mean square error sense.

[12] An understanding of the essentially statistical nature of annual earnings can be reinforced by considering three throws of dice. Let the first throw represent the cash flow in period 1, the second throw the cash flow in period 2 and the third throw cash flows from the purchase and sale of a fixed asset. Suppose the three throws produce a 4, 5 and 6. Total profit over the two periods is 15 or 7½ per period. The former, but not the latter, number is the result of a directly observable event. The periodic profit of 7½ would usually be thought more informative than the total profit of 15 because it contains information about the time rate at which profit is earned, but it could not be produced, as a directly observable measure, by any conceivable event from this experiment. However, it possesses a sampling distribution which provides information about likely outcomes of the 'experiment'. Currently, virtually nothing is known about the sampling distribution of earnings calculations. More is said about this matter in the concluding section.

[13] In particular, ignoring the 'lower of cost and market' rule. The problems of modelling that are not addressed in this paper.

In traditional accounting theory, earnings numbers are usually thought of as deterministic quantities. An extension of the numerical example used earlier in this section will help to clarify why earnings as conventionally calculated may possess attributes such as a variance. Adapting the single asset, two-period illustration to a world of uncertainty, however, introduces immediate complexity even in the simplest possible case, and shows the need for a more general mathematical formulation of the problem.

Suppose a two-period firm purchases a single fixed asset that costs either £6 or £5 at the beginning of the first period, with a probability of $\frac{1}{2}$ for each amount, and independently realises £1 or £2 at the end of the second period, also with respective probabilities of $\frac{1}{2}$ for those amounts. Assume further that it is certain that the effective life of the fixed asset is two periods. The four possible outcomes of the 'game of chance' of buying and selling the fixed asset are shown in Table 1 with their respective contributions to the firm's earnings figure, calculated using three alternative conventions.[15] The same three alternatives to recognising profits and losses as were calculated in the original deterministic example used earlier are considered, namely: 'funds flow', where costs are recognised in the periods in which they occur regardless of 'matching'; 'undepreciated earnings', where net costs are 'matched' and recognised on completion of the relevant activities; and 'depreciated earnings', using the overall expected loss of £2 per period for period 1 (i.e., [£5$\frac{1}{2}$−£1$\frac{1}{2}$])/2.[16] The straight-line method of calculating depreciation provides an estimated contribution per period of time which dominates the other alternatives to calculating contributions to earnings on a minimum mean squared error basis. Notice in this instance that the contribution per period which is deemed to be the subject of estimation is the actual, realised contribution of the firm averaged over its lifetime, not the theoretical, overall average of the underlying process which is £2 per period. The realised contribution is, of course, the significant figure from the firm's viewpoint.[17]

Despite the increased complexity compared to the deterministic case, this illustration is still almost trivial. The problem in developing this thesis further, unfortunately, is that adding further elements in illustrations like these (e.g., more than two periods, more than one asset, etc.) causes the number of possible outcomes to explode. An examination by cases becomes impractical and, in fact, hinders exposition. The issue now becomes whether it is possible to develop this approach with more complex probabilistic models. The following section discusses a model of this type that determines an optimal method for calculating straight-line depreciation in a specific case.

4. A mathematical model of accounting earnings optimally smoothed by straight-line depreciation

For the reasons just mentioned, generalisation of the approach outlined in the previous section to understanding the potentially useful statistical smoothing properties of the depreciation calculation requires a mathematical formulation of the model. This section briefly describes the limitations of one such model as it is analysed in this paper, formulates a mathematical expression for earnings incorporating an adjustment for depreciation, and explains in what sense such a function can be 'optimised' relative to the objective of smoothing earnings with respect to time. Details of the specific mathematical model thus specified are then given to show how it is possible (in some cases at least) to derive an exact formula for a depreciation adjustment so as to achieve this objective.

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[14] It is, in fact, a random sum of random numbers.

[15] The implied assumption of independence between the values of different types of account is discussed in the next section.

[16] An alternative and perhaps more usual calculation of period 1 depreciation, using knowledge of the original cost of the fixed asset, gives the same overall result.

[17] In the sequel, this distinction becomes unimportant since the model considered later involves a firm with an indefinite lifetime in which the long-term average and the lifetime average converge. However, this distinction is an important one in practice and in generalising this approach to finite decision horizon situations.

Table 1
Illustration of a simple single-activity, two-period model

			Funds flow					*Undepreciated earnings*					*Depreciated earnings*					*Case*
Expense	*Residual value*	*Contribution per period*	*Periods*		*Error*		*Squared error*	*Periods*		*Error*		*Squared error*	*Periods*		*Error*		*Squared error*	
			1	2	1	2		1	2	1	2		1	2	1	2		
6	2	2	6	−2	4	−4	16	0	4	−2	2	4	2	2	0	0	0	1
6	1	2.5	6	−1	3.5	−3.5	12.25	0	5	−2.5	2.5	6.25	2	3	−0.5	0.5	0.25	2
5	2	1.5	5	−2	3.5	−3.5	12.25	0	3	−1.5	1.5	2.25	2	1	0.5	−0.5	0.25	3
5	1	2	5	−1	3	−3	9	0	4	−2	2	4	2	2	0	0	0	4
Total squared error of estimate							49.5					16.5					0.5	
Variance (divisor 4)							12.375					4.125					0.125	

Notes: 1. Funds flow — fixed asset costs will be 5 or 6 with a probability of ½ each
Therefore there are four possible outcomes with a probability of ¼ (6, −2), (6, −1), (5, −2), (5, −1)
2. Undepreciated earnings — earnings recognition is delayed till the end of the second period, therefore earnings in the first period is zero. In the second period undepreciated earnings will be the sum of the funds flow (6−2=4); (6−1=5) etc.
3. Depreciated earnings — the first period contains the expected earnings while the second period takes up the residual.
4. In all three cases and for each period ‘Error’ is calculated as ‘Earnings−contribution per period’.
5. All monetary amounts are in £s.

4.1. Limitations of the Model

The mathematical model developed below assumes an infinite firm lifetime, stationary variables and independence between 'activity costs'. For present purposes, 'activity costs' can be thought of as being idealised accounts where each account records costs generated by a single physical process. In this context, one would have a distinct account, for example, for the purchasing, holding and selling of a particular type of fixed asset with all its associated depreciation adjustments. Both the assumption of an infinite life of the firm and the assumption of stationary processes are made for reasons of mathematical convenience and tractability. The most important assumption to understand, however, for present purposes, is that of statistical independence between the values of different accounts in the income statement.

For the purpose of this analysis, the assumption of independence implies that the level of costs, residual values and the length of the lives of depreciable assets are not affected by the values recorded in other accounts. Roughly speaking, this is the same as assuming that the costs incurred in using a fixed asset are independent of costs incurred in other activities pursued by the firm. More specifically, it implies that there are no covariances between the values of different accounts in the income statement and, consequently, that any reduction in the variance of a particular account (for instance, a fixed asset expense account) leads to exactly the same reduction in the overall variance of earnings. The assumption of independence therefore allows the analysis to focus on one 'class of activity costs' (e.g., an account dealing with the depreciation provisions for one type of fixed asset) in the knowledge that one can directly apply any conclusions about reductions in the variance for that one class of activities to draw the same conclusion about overall reductions in the variance of earnings. This is the strategy used below; only one fixed asset expense account is analysed, on the basis that a reduction in its variance will result in the same reduction of variance in the overall earnings figure.

Clearly the condition of independence between accounts will not be satisfied in some real-world situations (where, for example, a machine's life might be shortened by increased production) and it restricts the extent to which the specific results of the analysis (regarding the mathematical form of the optimum depreciation) can be generalised. However, it should be remembered that this model is, in itself, simply an illustration of a much broader thesis, i.e., the possibility of developing a method of statistical analysis for formulating questions about the properties of accounting numbers. All the model's assumptions (and the parameters to be estimated and the statistical criteria) could in principle be relaxed, although, of course, at the risk of considerably increased complexity in computations.

4.2. Formulation

Even with the restrictions just noted, formulating a general expression for the accounting earnings number disclosed in financial statements requires careful thought. The three types of income statement account referred to in the last section are distinguished from one another by two different 'rules of recognition'. Expense accounts and current asset expense accounts are based on 'short duration activities' (relative to the length of the accounting period), where costs are recognised solely on completion of the activity (e.g., as when an overhead expense is incurred in the case of an expense account or when a sale takes place in the case of a current asset expense account). Fixed asset accounts, in contrast, are based on 'long duration activities' and may also include depreciation provisions in addition to transaction costs. In other words, accounting recognition rules depend not only on the costs incurred in different types of activity, but also on whether they are classified as being of short or long duration, and exactly when they commenced and finished.

The six possible states that it is possible for short and long duration activities to take, relative to an accounting period, are shown in Figure 1. The Figure shows a graph with the resource set of a firm partitioned into 'activities'[18] on the vertical axis (indicated by the dotted lines) and time on the horizontal axis. The start, duration and finish times of the activities are shown by the continuous lines. Only activities *A2* through to *A4* would normally impact on accounts included in the income statement for the period $t-1$ to t. If the activities were of the short duration type, the net costs of *A2* and *A4*, which are completed in the accounting period, would be recognised in the income statement for that period. Costs incurred in *A3* and *A5*, which are incomplete at the end of the accounting period, would be ignored (by making a 'cost of sales' adjustment). However, if the activities were of the long duration type (i.e., 'fixed assets'), there might possibly be a depreciation charge for *A3* and *A5*, depending on the adjudged nature of the asset (whether it was depreciable) and the method of depreciation adopted. There are thus a number of basic recognition rules that need to be incorporated into a mathematical formulation of an expression for accounting earnings (after making the simplification referred to in footnote 13) if it is to be a reasonably faithful representation of accounting practices.

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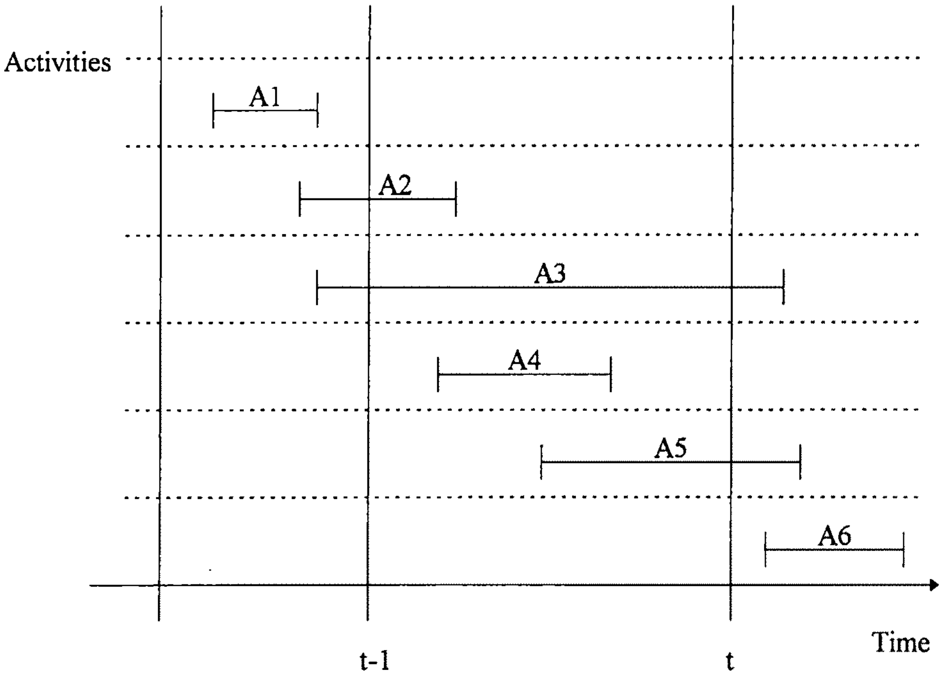
[18] 'Activities' contain only inputs and outputs related to each other through a sequence of production relations, in the way described in Willett (1988).

Figure 1
The six possible states of firm activities



The figure shows the start, duration and finish times of different types of activities, with *t-1* to *t* being the income statement period under consideration.

A direct mathematical formulation of these recognition rules, based explicitly on the conditions just described, was used by Willett (1991) to develop a simulation model of the earnings number. Unfortunately, that formulation proved to be too cumbersome for the purpose of analysis in developing the results reported in this paper, but an equivalent formulation that has turned out to be nicely tractable is the following expression for accounting earnings in period t, which are denoted by $Y(t)$.

$$Y(t) = \sum_{k} Y_k(t)$$

where (1)

$$Y_k(t) = \sum_{i=1}^{M_k(t)} C_{ik}(t) + \sum_{j=1}^{j=\delta_k} \alpha_k(j) \left\{ M_k\,(j,\,t) - M_k\,(j,\,t-1) \right\}$$

where C_{ik} is the accrued net invoice costs (revenues less expenses) incurred in the i^{th} occurrence[19] of the k^{th} activity class (i.e., an idealised account of the kind referred to above), $\alpha(j)$ is the accumulated depreciation over time period j for a fixed asset of the k^{th} class and δ_k is the maximum number of periods over which depreciation is charged. $M_k(t)$ is the number of activities of the k^{th} class being completed in the accounting period, and $M_k(j, t)$is the number of fixed assets of the k^{th} type purchased j periods before t and still held at t. Note that $M_k(j, t) - M_k(j, t - 1)$ is the change in the number of assets of the k^{th} type whose depreciation charge is $\alpha(j)$, over the accounting period from $t - 1$ to t. The second expression in (1) therefore represents the change in accumulated depreciation over that accounting period.

To see how expression (1) works in the case of a specific example, it can be applied to the illustration giving rise to the calculations in Table 1 of the previous section. In that case, $M(1) = 0$, $M(2) = 1$, $M(1, 1) = 1$ and $M(i, j) = 0$ otherwise, $\alpha(1) = 2$, $\alpha(2) = 4$ and $\delta = 2$. Consequently, for example, in case 1 of Table 1, $Y(1) = 0 + 2\ (1\text{-}0) = 2$ and $Y(2) = 4 + 2(1\text{-}0) + 4(0\text{-}1) = 2$. The other cases can be similarly worked out. These are evidently quite trivial calculations. In this sense, given the rapidly increasing level of complexity that the earlier illustrations were leading towards, the following analysis serves again to reinforce the necessity of dealing with illustrations more complex and realistic than the examples of Section 3 through mathematical and probabilistic methods.[20]

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[19] The i^{th} occurrence is always to be thought of as an instance of the smallest possible event of its type, e.g., the production of one unit of output from the activity.

For accounts other than fixed asset expense accounts, the final sum in (1), which models the various types of depreciation adjustments, is always zero. However, for present purposes, where depreciable assets are of concern and in view of the independence assumption, the analysis will proceed by focusing attention on one specific class of fixed asset expense account. It will establish how the variance of a particular component account of $Y(t)$, and thus $Y(t)$ itself, might be minimised by manipulation of the discretionary 'controllable decision' variables in expression (1), namely $\alpha_k(j)$ and δ_k. These are, of course, just those variables that are determined by the accountant's estimates of the residual values and useful lives of fixed assets. As only one particular account needs to be singled out for analysis to accomplish the paper's task, the subscript k will be dropped from expressions used in the remainder of the paper.

4.3. Criteria for Optimisation

In the numerical examples discussed in Section 3, straight-line depreciation reduced the variance of accounting earnings about the firm's longer term, per period profitability. As was remarked at the beginning of this section, however, determination of the conditions under which depreciation *in general* reduces the contribution of fixed asset expense accounts to the variance of the earnings process, requires the specification of an objective function relating the variance of $Y(t)$ to the choice of depreciation charge. In this regard, it can be seen that expression (1) divides into two main components: an undepreciated contribution to earnings, $K(t) = \sum_{i=1}^{i=M(t)} C_i(t)$, consisting of actual, realised revenues and expenses which is a basic ingredient in any account; and a depreciation function $D(t)$, with arguments $\alpha(i)$, δ and t, which is the remainder of the RHS of the expression and which appears only in fixed asset expense accounts. It can thus be seen that $Y(t)$ is the sum of the two random components $K(t)$ and $D(t)$. Consequently, $\mathbf{E}Y(t) = \mathbf{E}K(t) + \mathbf{E}D(t)$.[21]

Either from a knowledge of how accounting numbers are constructed or by examining examples such as those in Table 1, it can be seen that $\mathbf{E}D(t) = 0$ and $\mathbf{E}Y(t) = \mathbf{E}K(t)$ over a firm's lifetime. That is, the average contribution of an activity to earnings per period over a firm's lifetime is the same as the average contribution to funds flow per period and, by a simple extension, these are both the same as the average contribution to cash flow per period. Furthermore, under the conditions of stationarity that are assumed in this paper, the same relationships between $\mathbf{E}Y(t)$, $\mathbf{E}K(t)$ and the average contribution to cash flow per period will exist in the limit as the length of the relevant decision horizon tends towards infinity. Consequently, in asking whether the function $D(t)$ 'smooths' $K(t)$ in producing $Y(t)$, it is sufficient simply to pose the question: is $\text{Var}Y(t) < \text{Var}K(t)$ by choice of $D(t)$?

This means that the smoothing properties of the depreciation function $D(t)$ can be assessed by comparing the variance of $D(t)$ and the covariance of $K(t)$ and $D(t)$ with the variance of $K(t)$. This follows from the fact that:

$$\text{Var } Y(t) = \text{Var } K(t) + \text{Var } D(t) + 2 \text{ Cov } (K(t), D(t)) \qquad (2)$$

from which it further follows that:

$$\begin{gathered}\text{Var } Y(t) < \text{Var } K(t) \textit{ if and only if} \\ \text{Cov } (K(t), D(t)) < 0 \textit{ and} \\ \tfrac{1}{2} \text{ Var } D(t) < | \text{ Cov } (K(t), D(t)) \, |. \end{gathered} \qquad (3)$$

This is, in a sense, an objective function that can be optimised by choice of a suitable depreciation function where the discretionary variables are, as mentioned before, the method of depreciation, the residual values and the useful lifetime of the fixed assets involved.

4.4. Model Development

With this much background, formal analysis of (1) can begin in earnest. As will be appreciated from the preceding discussion, the *accounting earnings function* for a given class of activities is

$$Y(t) = K(t) + D(t) \qquad (4)$$

where $K(t)$ is the funds flow from activities finishing between times $t-1$ and t, and $D(t)$ is the change in the total depreciation set aside, at accounting date t. We define $Q(i, t)$ to be the number of activities of the relevant class which started i full periods previously, i.e., starting in the accounting period immediately prior to $t-i$, and which finish during the period $t-1$ to t. The costs incurred in these activities will be denoted by C_{ij} for $j = 1, 2, \ldots Q(i, t)$. Then

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[20] Despite the cautionary remarks made earlier concerning the assumption of independence among different accounts, in theory expression (1) could be thought of as a collection of aggregated fixed asset accounts just as easily as a single type of fixed asset. Aggregation of individual fixed asset accounts does not change the formulae described in expression (1), but would change the probability laws governing the random variables. However, it is probably easier from an expositional viewpoint to stick to interpreting these expressions in terms of single asset categories and assume statistical independence between different types of activity. As is explained in the text, individual reductions in the variance of the values of each such account over time then imply an equal reduction in the overall variance of earnings.

[21] $D(t)$ is a random variable because it is a function of the random variable $M(i, t)$.

$$K(t) = \sum_{i=0}^{\infty} \sum_{j=1}^{Q(i,t)} C_{ij}. \tag{5}$$

The accumulated depreciation up to time t is $\sum_{i=0}^{\infty} \alpha(i) M(i,t)$ where $M(i, t)$ is the number of activities which started i full periods previously and continue beyond t, while $\alpha(i)$ is the accumulated depreciation on these activities. The depreciation component of the earnings function is then

$$D(t) = \sum_{i=0}^{\infty} \alpha(i) M(i,t) - \sum_{i=0}^{\infty} \alpha(i) M(i,t-1). \tag{6}$$

In a steady state model, both $M(i, t)$ and $M(i, t-1)$ will have the same distribution so that $\mathbf{E}D(t) = 0$. Now $M(i, t-1) = M(i+1, t) + Q(i+1, t)$, so that, substituting in (6),

$$\begin{aligned} D(t) &= \sum_{i=0}^{\infty} \alpha(i) M(i,t) - \sum_{i=0}^{\infty} \alpha(i)[M(i+1,t) + Q(i+1,t)] \\ &= \sum_{i=0}^{\infty} \alpha(i) M(i,t) - \sum_{j=0}^{\infty} \alpha(j-1)[M(j,t) + Q(j,t)] \\ &= \sum_{i=0}^{\infty} [\alpha(i) - \alpha(i-1)] M(i,t) - \sum_{j=0}^{\infty} \alpha(j-1) Q(j,t) \\ &\equiv D_1(t) - D_2(t) \end{aligned} \tag{7}$$

where we have taken $\alpha(-1)=0$ for simplicity. Equation (7) provides a decomposition of the depreciation component in which $D_1(t)$ represents the extra period's depreciation for continuing activities, while $D_2(t)$ 'writes off' the depreciation accumulated for those activities whose costs have been included at accounting date t.

We will assume below that the C_{ij} are independent and identically distributed with mean μ_c and that the $M(i,t)$, $Q(i,t)$ and C_{ij} are all mutually independent with $u_i = \text{Var } M(i, t)$ and $v_i = \text{Var } Q(i, t)$.

From (4), the earnings function has variance

$$\text{Var } Y(t) = \text{Var } K(t) + \text{Var } D(t) + 2 \text{ Cov } (K(t), D(t)). \tag{8}$$

Now our assumptions imply that $K(t)$ is independent of $D_1(t)$ so that, from (7),

$$\text{Cov } (K(t), D(t)) = -\text{Cov } (K(t), D_2(t))$$

Moreover, conditionally on the numbers of finishing activities of various durations, and letting $\mathbf{Q} = \{Q(i, t);\ i = 1,2 \ldots\}$, $D_2(t)$ is non-random so that

$$\text{Cov } \{K(t), D_2(t) | \mathbf{Q}\} = 0$$

and

$$\begin{aligned} \text{Cov } [K(t), D_2(t)] &= \mathbf{E} \text{ Cov } \{K(t), D_2(t) | \mathbf{Q}\} + \text{Cov } [\mathbf{E}\{K(t)|\mathbf{Q}\}, \mathbf{E}\{D_2(t)|\mathbf{Q}\}] \\ &= 0 + \text{Cov} \left[\sum_{j=0}^{\infty} \mu_c\, Q(j,t),\ \sum_{j=1}^{\infty} \alpha(j-1)\, Q(j,t) \right]. \end{aligned}$$

Therefore

$$\text{Cov } (K(t), D(t)) = -\mu_c \sum_{j=1}^{\infty} \alpha(j-1)\, v_j. \tag{9}$$

Similarly, since $D_1(t)$ and $D_2(t)$ are independent,

$$\begin{aligned} \text{Var } D(t) &= \text{Var } D_1(t) + \text{Var } D_2(t) \\ &= \sum_{j=0}^{\infty} [\alpha(j) - \alpha(j-1)]^2 u_j + \sum_{j=1}^{\infty} \alpha(j-1)^2 v_j. \end{aligned} \tag{10}$$

4.5. The Case of Straight-line Depreciation

In the most frequently used method, linear depreciation, we choose a constant amount α and a time period δ and let

$$\alpha(i) = \begin{cases} (i+1)\alpha; & i = 0, 1, \ldots, \delta - 1, \\ \alpha\delta; & i = \delta, \delta+1, \ldots \end{cases} \tag{11}$$

that is, we charge depreciation α at the first accounting date and add α on each subsequent date until a maximum of $\alpha\delta$ is reached. Typical choices would be $\delta = \gamma$ where γ is the expected duration and $\alpha = \mu_c/\gamma$, i.e., arranging that the depreciation accumulated over the activity's expected duration matches the expected costs. However, we will see that these choices may be sub-optimal.

Evaluating (10) with linear $\alpha(i)$ we get

$$\text{Var } D(t) = \alpha^2 R(\delta) \tag{12}$$

where

$$R(\delta) = \sum_{j=0}^{\delta-1} u_j + \sum_{j=1}^{\delta-1} j^2 v_j + \delta^2 \sum_{j=\delta}^{\infty} v_j. \tag{13}$$

Similarly (9) becomes

$$\text{Cov } (K(t), D(t)) = -\alpha\mu_c\, S(\delta)$$

where

$$S(\delta) = \sum_{j=1}^{\delta} j v_j + \delta \sum_{j=\delta+1}^{\infty} v_j. \tag{14}$$

Consequently, the variance of the accounting earnings function is, from (8),

$$\operatorname{Var} Y(t) = \alpha^2 R(\delta) - 2\,\alpha\mu_c\, S(\delta) + \operatorname{Var} K(t)$$

where Var $K(t)$ does not depend on α or δ. For a fixed depreciation period δ, the minimum variance is attained by choosing

$$\alpha = \mu_c\, S(\delta)/R(\delta) \tag{15}$$

in which case we have

$$\operatorname{Var} Y(t) = \operatorname{Var} K(t) - \mu_c^2\, S^2(\delta)/R(\delta) \tag{16}$$

so that there is always a reduction in variance over undepreciated earnings $K(t)$. The extent of the reduction depends on the choice of δ, and this too can be engineered to obtain an optimal result. However, δ may have to be determined numerically by a search method, as in our detailed example below.

4.6. A Special Case

A more specific model is now considered where starts occur randomly at rate λ per unit time, i.e., as a Poisson process, while the duration times, X, are independent and exponentially distributed with mean $\gamma = 1/\theta$. The upper tail, or survivor function, of X is therefore $P(X \geq x) = e^{-\theta x}$, for $x > 0$. Consequently, the $M(j,t)$ and $Q(j,t)$ are all independent and Poisson distributed with

$$u_j = \operatorname{Var} M(j,t) = \mathbf{E}M(j,t) = \frac{\lambda}{\theta} e^{-j\theta}\left[1 - e^{-\theta}\right] \tag{17}$$

and

$$v_j = \operatorname{Var} Q(j,t) = \mathbf{E}Q(j,t) = \frac{\lambda}{\theta} e^{-(j-1)\theta}\left[1 - e^{-\theta}\right]^2. \tag{18}$$

For details of this derivation, see Lane and Willett (1994). This model is well known for its tractability in the analysis of queuing and inventory problems etc., and seems a sensible starting point for further investigation. A more general model allowing for a periodic rate of starts is explored in Lane and Willett (1994).

To evaluate the optimal α for a given δ, we substitute (17) and (18) into (13) and (14) to get

$$S(\delta) = \frac{\lambda}{\theta}\left[1 - e^{-\theta}\right]^2 \left[\sum_{j=1}^{\delta} j e^{-(j-1)\theta} + \delta \sum_{j=\delta+1}^{\infty} e^{-(j-1)\theta}\right] \tag{19}$$

and

$$R(\delta) = \frac{\lambda}{\theta}\left[1 - e^{-\theta}\right]\left[\sum_{j=0}^{\delta-1} e^{-j\theta} + (1 - e^{-\theta}) \sum_{j=1}^{\delta-1} (j+1)^2 e^{-(j-1)\theta} + \delta^2 (1 - e^{-\theta}) \sum_{j=\delta}^{\infty} e^{-(j-1)\theta}\right]. \tag{20}$$

These expressions are evaluated in the Appendix, giving

$$S(\delta) = \frac{\lambda}{\theta}\left[1 - e^{-\delta\theta}\right] \tag{21}$$

and

$$R(\delta) = \frac{\lambda}{\theta}\, \frac{2}{1 - e^{-\theta}} \left[1 - (\delta+1)e^{-\delta\theta} + \delta e^{-(\delta+1)\theta}\right]. \tag{22}$$

Consequently, from (15), the optimum α for fixed δ is

$$\hat{\alpha}(\delta) = \mu_c \frac{(1 - e^{-\delta\theta})(1 - e^{-\theta})}{2\left[1 - (\delta+1)e^{-\delta\theta} + \delta e^{-(\delta+1)\theta}\right]}.$$

As $\delta \rightarrow \infty$, the optimum $\hat{\alpha}(\delta)$ approaches $\frac{\mu_c}{2}(1 - e^{-\theta})$, i.e., half the expected activity cost multiplied by the probability that the duration time is less than one period. While this limiting case is of little practical significance, it gives some insight into the relationship between α, θ and δ. To jointly optimise α and δ, we maximise the reduction in variance relative to the undepreciated funds figure. This is given by the second term in (16), i.e., $\mu_c^2\, S(\delta)/R(\delta)$. Omitting constants, we need to choose δ, the period over which depreciation takes place, to maximise the function

$$f(\delta) = \frac{(1 - e^{-\delta\theta})^2}{1 - (\delta+1)e^{-\delta\theta} + \delta e^{-(\delta+1)\theta}}.$$

In Table 2, $f(\delta)$ is evaluated for positive integer values of δ up to 10, and a range of values of the expected duration time, $\gamma = 1/\theta$. Interestingly, for low values of $\gamma \leq 5$, the optimal depreciation period $\hat{\delta}$ is close to the conventional choice of $\delta = \gamma$. However, thereafter, it increasingly lags behind γ, reaching a value less than 8 for $\gamma = 20$ and only 12 when $\gamma = 50$, as can be seen in Table 3, column 2. Table 3 also compares, for a range of expected duration times γ, the optimal rate of depreciation, $h(\gamma) = \hat{\alpha}(\hat{\delta})/\mu_c$, with the conventional rate, $1/\gamma$. The '% Diff.' column gives the difference

Table 2
Values of f(δ) for integer values of δ and γ = 1/θ

γ \ δ	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
2	1.000	1.166	1.175	1.147	1.114	1.084	1.061	1.043	1.030	1.021
3	1.000	1.211	1.252	1.239	1.211	1.178	1.148	1.120	1.097	1.077
4	1.000	1.237	1.300	1.303	1.284	1.255	1.225	1.196	1.169	1.144
5	1.000	1.254	1.333	1.348	1.338	1.315	1.289	1.261	1.233	1.207
10	1.000	1.291	1.409	1.458	1.476	1.477	1.468	1.454	1.436	1.417
15	1.000	1.305	1.437	1.502	1.533	1.546	1.548	1.544	1.535	1.523

$$\text{where } f(\delta) = \frac{(1-e^{-\delta\theta})^2}{1-(\delta+1)e^{-\delta\theta}+\delta e^{-(\delta+1)\theta}}$$

as a percentage of the optimal rate. These range from an overstatement of 50% when γ is 2 accounting periods, to an understatement of 74% when γ is 50. The curves $h(\gamma)$ and $1/\gamma$ are plotted in Figure 2 from values tabulated in columns 4 and 5 of Table 3. From column 6, we see that this understatement of depreciation reaches a maximum of around 7% of μ_c, the expected cost per activity, for values of the conventional rate $1/\gamma$ between 1/13 and 1/20, before declining slightly to reach just under 6% of μ_c by $1/\gamma = 1/50$.

5. Conclusions

One of the objectives of this work has been to demonstrate how it is possible to use probability models to examine the properties of accounting numbers that would be obscured, and perhaps impossible to deduce, with more traditional accounting theory frameworks. The analysis has shown how it is possible to construe accounting numbers as statistics, and optimise certain properties relative to a choice of decision parameter and loss function. In this case, it was demonstrated how the components of the earnings figure may be subjected to a stochastic control technique, in the context of a specific model, so as to give a smoother predictor over time, in the quadratic loss sense, of their contribution to long-run average cash flow.

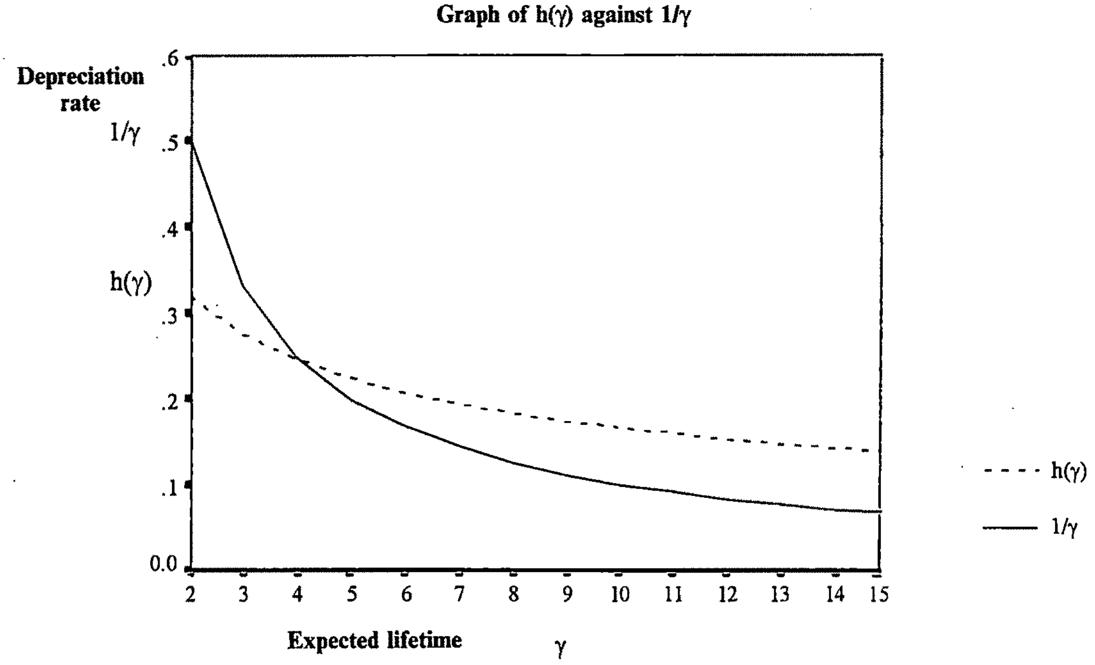
The main conclusions of the paper based on the specific model examined are as follows. Deprecia-

Table 3
Comparison of ordinary straight-line depreciation (*1/γ*) with optimal straight-line depreciation (*h(γ)*)

γ	$\hat{\delta}$	f($\hat{\delta}$)	h(γ)	1/γ	Diff.	% Diff.
2	2.58	1.18	0.320	0.500	−0.180	−56
3	3.11	1.25	0.275	0.333	−0.058	−21
4	3.56	1.31	0.246	0.250	−0.004	−2
5	3.96	1.35	0.224	0.200	0.024	11
6	4.32	1.38	0.206	0.167	0.039	19
7	4.65	1.41	0.193	0.143	0.050	26
8	4.97	1.44	0.183	0.125	0.058	32
9	5.26	1.46	0.173	0.111	0.062	36
10	5.54	1.48	0.166	0.100	0.066	40
11	5.80	1.50	0.159	0.091	0.068	43
12	6.05	1.51	0.152	0.083	0.069	45
13	6.30	1.52	0.147	0.077	0.070	48
14	6.53	1.54	0.142	0.071	0.071	50
15	6.76	1.55	0.138	0.067	0.071	51
20	7.79	1.59	0.120	0.050	0.070	58
50	12.27	1.72	0.078	0.020	0.058	74

$$\text{where } h(\gamma) = \frac{(1-e^{-\delta\theta})(1-e^{-\theta})}{2(1-(\delta+1)e^{-\delta\theta}+\delta e^{-(\delta+1)\theta})}, \text{ with } \theta = 1/\gamma$$

Figure 2
Comparison of optimal and conventional straight-line depreciation rates



tion construed in this manner need not be arbitrary but may be engineered to improve the statistical properties of earnings as an estimator of long-run cash flow. In this case, when assets with lives greater than five years are involved, the usual straight-line depreciation calculation spreads expected costs over too long a period. In fact, it is unlikely that a writing-off period in excess of 10 years could be justified, given the time horizons adopted in most business decision-making. If this result turns out to apply to a wider class of models, it would limit management's ability to justify the manipulation of earnings by taking a 'no depreciation' position on the grounds that the depreciation of long-lived assets is of negligible effect. This point is particularly relevant to the question of the length of time over which intangible assets should be amortised.

There are many implications for further research. The behaviour of the basic model of earnings needs to be studied under different assumptions concerning activity start times and duration times. Alternative, non-linear, methods of depreciation need to be examined to discover whether their impact on the statistical characteristics of earnings is significantly different from that of straight-line depreciation. Information about factors other than time, for example physical usage, could be incorporated into the basic model to enhance its estimating properties. Discrete time, statistical decision procedures governing the activity set could be introduced to generate a stochastic time series of earnings, the behaviour of which could be related back to the basic model's measurable activity variables. The model could also be amended to study its estimation properties with respect to alternative decision parameters, such as economic income and the internal rate of return. *In fact, it is clear that this technique could be extended, with the aid of numerical methods, to develop similar analyses of any accounting number of any decision parameter under any loss function.*

The analysis in terms of variance reduction of the earnings figure carried out in this paper is, in fact, only part of the story regarding the statistical effect depreciation adjustments have on such performance measures. Recent work (Hillier, 1994) shows that depreciation adjustments typically transform otherwise bimodal distributions towards the Gaussian, a transformation that is particularly strongly marked in the case of single fixed asset expense accounts. It should be possible, by using ordinary software packages, to program business computer systems to estimate the empirical distributions of these and other accounting numbers and to optimise accounting calculations at the shop-floor level for specific decision purposes. Clearly, if this could be done, it would have considerable implications not only for important aspects of accounting theory research, but also for the reporting of accounting information at many different levels within and without the accounting entity.

Appendix

Derivation of equations (21) and (22)

We evaluate $S(\delta)$ and $R(\delta)$ from (19) and (20), using well-known identities for partial sums of geometric and related series. We let $x = e^{-\theta}$ for simplicity.

$$\sum_{i=0}^{\delta} x^i = \frac{1-x^{\delta+1}}{1-x} \tag{A1}$$

$$\sum_{i=\delta}^{\infty} x^i = \frac{x^\delta}{1-x} \tag{A2}$$

$$\sum_{i=1}^{\infty} i x^{i-1} = \frac{1-(\delta+1)x^\delta+\delta x^{\delta+1}}{(1-x)^2} \tag{A3}$$

$$\sum_{i=2}^{\delta} i(i-1)x^{i-2} = \frac{2-(\delta+1)\delta x^{\delta-1}+2(\delta^2-1)x^\delta-\delta(\delta-1)x^{\delta+1}}{(1-x)^3}. \tag{A4}$$

From (19), using (A3) and (A2),

$$\frac{\theta}{\lambda} S(\delta) = (1-x)^2 \left\{ \sum_{i=1}^{\delta} i x^{i-1} + \delta \sum_{i=\delta+1}^{\infty} x^{i-1} \right\}$$

$$= 1-(\delta+1)x^\delta+\delta x^{\delta+1}+\delta(1-x)x^\delta$$

$$= 1-x^\delta$$

from which (21) follows.

From (20),

$$\frac{\theta}{\lambda}\frac{R(\delta)}{(1-x)^2} = \frac{1}{(1-x)}\sum_{j=0}^{\delta-1} x^j + \sum_{j=1}^{\delta} j^2 x^{j-1} + \delta^2 \sum_{j=\delta+1}^{\infty} x^{j-1}$$

$$= \frac{1-x^\delta}{(1-x)^2} + \sum_{j=2}^{\delta} j(j-1)x^{j-1} + \sum_{j=1}^{\delta} j x^{j-1} + \delta^2 \frac{x^\delta}{1-x}$$

$$= \frac{1-x^\delta}{(1-x)^2} +$$

$$\frac{x\left\{2-(\delta+1)\delta x^{\delta-1}+2(\delta^2-1)x^\delta-\delta(\delta-1)x^{\delta+1}\right\}}{(1-x)^3}$$

$$+\frac{1-(\delta+1)x^\delta+\delta x^{\delta+1}}{(1-x)^2}+\frac{\delta^2 x^\delta}{1-x}.$$

Therefore

$$(1-x)\frac{\theta}{\lambda}\mathrm{R}(\delta) = (1-x)(1-x^\delta)+2x-(\delta+1)\delta x^\delta$$

$$+2(\delta^2-1)x^{\delta+1}-\delta(\delta-1)x^{\delta+2}$$

$$+(1-x)(1-(\delta+1)x^\delta+\delta x^{\delta+1})+\delta^2 x^\delta(1-x)^2$$

$$=2(1-(\delta+1)x^\delta+\delta x^{\delta+1})$$

from which (22) follows.

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Concepts Associated with the 'True and Fair View': Evidence from Singapore

Chan Kee Low and Hian Chye Koh*

Abstract—This study investigated the differential perceptions of the 'true and fair view' among accountants, bank officers and managers in Singapore and examined whether 'true and fair' was perceived to mean compliance with GAAP and compliance with legal requirements. The survey questionnaire required respondents to evaluate simultaneously 12 phrases (including the 'true and fair view') using the card-sorting technique. The questionnaire was given to 300 accountants, 100 bank officers and 200 managers, yielding response rates of 73%, 64% and 81.5% respectively, and 74.33% (or 446) overall. Descriptive statistics, individual differences scaling analysis (INDSCAL) and cluster analysis were performed to analyse the data. The results showed that perceptions of the true and fair view did not differ significantly across the three groups. Further, 'true and fair' was clearly distinguished from compliance with GAAP and/or legal requirements. Instead, it was grouped with 'not misleading', 'absence of material errors' and 'objective and free from bias'.

1. Introduction

The requirement for financial statements to be 'true and fair' is widespread. This requirement has long been embodied in the accounting standards and/or legal regulations of several countries, including those in the European Community, Australasia, South-east Asia and Africa. It has also been given a unique status in the form of the 'true and fair override', where financial statements can be exempted from compliance with standards and requirements if such compliance does not lead to a 'true and fair view'. The importance of the true and fair view is well summarised by Leach's (1981:7) suggestion that it provides the 'ultimate foundation' for financial reporting.

Despite the significant role that the true and fair view plays in accounting, auditing and reporting, the concept has attracted much controversy and debate about its meaning. Walton (1993:49), for example, suggested that 'no one knows what it means' and Jones (1994:26) cautioned that 'true and fair' may prove difficult for even the 'most eminent and skilled accountants to define'. Not surprisingly, therefore, Parker and Nobes (1994: xiii) concluded that the true and fair view is 'a central but mysterious feature of financial reporting', which is both at once 'overriding and undefined'.

That the true and fair view may mean different things in different countries has been noted by Nobes (1993) and Higson and Blake (1993). In fact, the meaning of the different translations of true and fair in the European Community has been the subject of some discussion, and there is no certainty that it means the same thing in different member countries (see Alexander, 1993; Burlaud, 1993; and Hudack and Orsini, 1993).

In spite of the ambiguity of the true and fair view, there is a widely held opinion that it can be equated with compliance with GAAP (generally accepted accounting principles) and legal requirements. Rutherford (1985) argued that GAAP are all that the accounting profession has by way of a frame of reference within which professional judgments can be made. Hence, the true and fair view might be interpreted as compliance with GAAP. Rutherford (1988) added that compliance with GAAP is the only pragmatic approach to the interpretation of the true and fair view. In fact, there seems to be little consensus as to what the true and fair view could mean otherwise. It is difficult to imagine 'true and fair' results that are not obtained and communicated by adherence to a set of rules.

The general interpretation of the true and fair view as compliance with GAAP and compliance with legal requirements is also consistent with the normative works of Benson (1962), Cowan (1965), Edey (1971), Boussard (1981), Rutherford (1985 and 1988), Walton (1991 and 1993) and Gearin and Khandelwal (1995), and the empirical works of Nobes and Parker (1991), Parker and Nobes (1991) and Deegan et al. (1994). Further, as Parker and Nobes (1994:16) commented, even those who interpret 'true and fair' differently from compli-

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*The authors are senior lecturers at the School of Accountancy and Business, Nanyang Technological University, Nanyang Avenue, Singapore 639798. This paper was submitted in July 1993 and accepted in December 1996.

Table 1
List of phrases and references

Phrase used in questionnaire	Abbreviation	Illustrative reference*
1. Absence of material errors	AM	Fowle (1992)
2. Accurate and correct	AC	Rutherford (1985)
3. Compliance with GAAP	CG	Hoffman and Arden (1983)
4. Compliance with legal requirements	CL	Radcliffe (1990)
5. Correspondence with economic facts	CE	Lee (1982)
6. Exercise of proper judgment	EP	ASC (1975)
7. Full and proper disclosure	FP	Rutherford (1985)
8. Healthy financial position/performance	HF	AARF (1990) (See also Godsell, 1991)
9. Not misleading	NM	Nobes and Parker (1991)
10. Objective and free from bias	OF	Lee (1981)
11. Relevant and useful	RU	Walker (1984)
12. True and fair	TF	—

*These references show illustrative examples of sources where the respective phrases are associated with the true and fair view, whether directly or indirectly.

ance with GAAP and legal requirements often assume that true and fair accounts will 'comply with statutory requirements and accounting standards'. The 'compliance' interpretation of the true and fair view is also consistent with accounting practices in several countries, including the US (Pattillo, 1965), South Africa (South African Companies Act, 1973), Australia (Pound, 1985) and Germany (Busse von Colbe, 1984).

In Singapore, where this study was conducted, the Companies Act requires the auditor to express an opinion on whether the accounts are drawn up so as to show a true and fair view of the company's state of affairs and results. The true and fair requirement is a legal concept, although no definition of it has been attempted by the legislators or courts (Arens, Loebbecke and Ambanpola, 1993). Generally, the application of the true and fair view in Singapore is guided by the Statement of Auditing Practice No. 6 (SAP 6) (ICPAS, 1986). SAP 6 in turn relies on the counsel's opinion sought by the Accounting Standards Committee (ASC) in 1983 (Hoffman and Arden, 1983). In fact, the counsel's opinion is reproduced in, and forms almost the entire, SAP 6.

Of particular relevance here is the counsel's opinion that courts will treat compliance with accepted accounting principles as prima facie evidence that the accounts are true and fair. Conversely, deviation from accepted accounting principles will provide prima facie evidence that the accounts are not true and fair. That is, 'true and fair' can generally be interpreted with reference to compliance with GAAP and legal requirements. This position is further strengthened in the UK (and presumably in Singapore too) with the recent update of the counsel's opinion (Arden, 1993). Accounting standards and standard-setters are now recognised in law, and accounting standards may properly be regarded as a source of law (Parker and Nobes, 1994). With counsel's opinion (Hoffman and Arden, 1983; and Arden, 1993), it appears that the close association between true and fair and compliance with GAAP and legal requirements is now explicit.

The objective of this study is to investigate the concepts associated with the true and fair view. In particular, it examines whether differential perceptions among accountants, bank officers and managers in Singapore exist, and whether the true and fair view is perceived to mean compliance with GAAP and with legal requirements.

The remainder of the paper is divided into three major sections. Section 2 describes the research methodology used in the study and Section 3 reports the results and examines their implications. Finally, the findings, limitations of the study and suggestions for future research are highlighted in Section 4.

2. Research methodology

The research methodology employed in the study is summarised below.

2.1. Questionnaire

The study comprises a questionnaire survey of accountants', bank officers' and managers' perceptions of the true and fair view. To construct the questionnaire, the concepts and terms associated with the true and fair view were first listed. This was done through a review of the existing true and fair literature by the authors. Major writings on the true and fair view and the references contained in them were reviewed. Admittedly, judgment was used to derive and select the final list of phrases. Judgment was also used to limit the list to 12 phrases to ensure that the task of completing the questionnaire would be reasonable and manageable. Thus, other possible phrases (such as 'substance over form', 'consistency and uniformity', 'faithful picture' and 'exact and distinct') were not included in the study. This limitation is highlighted in Section 4.

The literature review exercise yielded 12 phrases (including 'true and fair'), which are included in the survey questionnaire (in alphabetical order). A list of the 12 phrases and illustrative references is given in Table 1. The survey questionnaire is a structured questionnaire in that respondents respond to close-ended questions only.

The questionnaire comprises two sections. The first section attempts to measure the similarity/dissimilarity of the 12 phrases identified earlier. This is done by asking respondents to evaluate simultaneously the 12 phrases and to put similar phrases into the same groups (i.e., the so-called card-sorting technique). To illustrate, suppose a respondent thinks that 'true and fair', 'not misleading' and 'absence of material errors' are similar, and that 'relevant and useful' and 'accurate and correct' are similar, but that the first set of phrases is not similar to the second set of phrases. In this case, the respondent should assign the first three phrases to one group and the next two phrases to a different group.

The similarity measure between any pair of phrases is measured by the number of times that respondents put that pair together in the same group. This measurement algorithm is logical because if respondents perceive two phrases to be very similar then it can be expected that the two phrases will be assigned to the same group very frequently. The card-sorting technique results in a (12 x 12) similarity (or proximity) matrix for each group of accountants, bank officers and managers, respectively.

The second section of the questionnaire requests demographic information such as the respondent's functional area, age, years of working experience and education level. Such information is useful for understanding respondents' characteristics. As can be seen, the survey questionnaire is a short and simple one.

The questionnaire was pre-tested before administration on a sample of 20 MBA students in a research and statistical methods class. No major negative feedback was received. However, all feedback was carefully considered and incorporated (where necessary) in the final version of the survey questionnaire. Besides providing valuable feedback to improve the questionnaire, the pre-testing also suggested that the number of columns needed for the questionnaire (where the number of columns corresponds to the number of groups for the card-sorting technique) was adequate. At the development stage, six columns were incorporated in the questionnaire on the bases of judgment, experience and intuition.

2.2. Sample

The study attempts to assess the perceptions of the true and fair view among accountants and users of financial statements in Singapore. For this study's purpose, users are classified into two groups. The first group comprises bank officers. Bank officers use financial statements quite intensively and extensively in their jobs for specific purposes (e.g., lending or investing) and have been a target for many past research studies (see, for example, the summary tables in Strawser, 1991). Hence, they are considered an appropriate user group to study perceptions of the true and fair view. The second group comprises managers, who use financial statements mainly for internal and more general (management) purposes. They are also deemed an appropriate user group for this study. Since managers are expected to have more interaction with accountants/auditors than bank officers, the two groups' different characteristics make them interesting targets for investigation.

Given the above, the three populations involved in the study are accountants, bank officers and managers. The three samples from the respective populations were obtained in the following manner. For accountants, a representative sample of the Big Six and other local public accounting firms in Singapore was approached to solicit participation in the study. Public accounting firms that agreed to participate were then given copies of the survey questionnaire. A total of 300 questionnaires was given to the accountants group. For bank officers, cooperation of a representative sample of international and local banks in Singapore was sought for help. A total of 100 questionnaires were distributed to the participating banks' officers. Both the representative samples of public accounting firms and banks were selected randomly from public directories. Finally, for managers, a random sample was taken from a listing of companies and organisations in Singapore (namely, the *Singapore 1,000*). A total of 200 questionnaires was distributed to the managers' group. To reduce response bias, all respondents returned the completed questionnaires directly to the authors via stamped, self-addressed envelopes.

It can be noted that the random sampling procedure was applied only to the organisations (i.e., public accounting firms, banks and companies) but not directly to the respondents (i.e., accountants, bank officers and managers). Thus, the final sample of respondents is not truly random. This limitation is discussed later in Section 4.

2.3. *Statistical Methods*

In the study, the individual differences scaling analysis (INDSCAL), a multidimensional scaling (MDS) technique, is used (see Carroll and Chang, 1970). The results can show whether perceptions of the true and fair view differ among accountants, bank officers and managers, and also, if they do so, how they do. In addition, the results can identify the common perceptual map underlying the three groups' perceptions, if any exists. This common map can be used to assess whether 'true and fair' means compliance with GAAP and legal requirements. That is, from the similarity matrix of the 12 phrases discussed earlier (see questionnaire section), INDSCAL is used to plot the relative perceptions of the 12 phrases on a common perceptual map for the three groups of respondents (accountants, bank officers and managers). By examining the relative positions of the 12 phrases on the perceptual map, inferences can be made about the degree of association (i.e., similarity or dissimilarity) among the 12 phrases (Jones and Koehly, 1993:97–100).

While the application of MDS techniques is not common in accounting research, it is not entirely new. For example, MDS has been employed by Libby (1979) to study the perceived differences in the messages intended by audit reports; by Tan, Koh and Low (1989) to study differential perceptions of auditing terms; and by Schleifer and Shockley (1990) to investigate the reactions of accountants and financial statement users to policies recommended by the Cohen Commission.

Finally, cluster analysis is applied to the INDSCAL results and similarity matrix (transformed to distances) to enable a more objective interpretation of the perceptual map with respect to concepts and terms associated with, or not associated with, the true and fair view. A discussion of INDSCAL and cluster analysis can be found in Green, Carmone and Smith (1989:117–128; 186–188).

3. Results and implications

The questionnaires were administered in June 1992 and collected by the end of July 1992. Out of the 300 questionnaires given to accountants, 219 were returned, giving a response rate of 73%. As for bank officers, the response rate was 64 out of 100 (i.e., 64%). Finally, for managers, 163 out of 200 (i.e., 81.5%) responded. The total number of responses adds up to 446 out of 600 (i.e., 74.3%).

Descriptive statistics indicate that almost all the respondents (98.9% or 441) have diploma qualifications, professional qualifications and/or university education. This is not unexpected for accountants, bank officers and managers. Also, the average number of years of working experience is 5.5 years, and the average age is 33.3 years. The profile of the respondents is similar to that of middle-level managers in Singapore.

As discussed earlier, accountants', bank officers' and managers' perceptions of true and fair view are measured in the first section of the questionnaire by using the card-sorting technique. By counting the frequency any two phrases are grouped together, the perceived similarity of the two phrases is derived. Thus, there is a (12 x 12) similarity matrix for each of the three groups.

3.1. *INDSCAL Results*

Assuming that a common perceptual map exists among accountants, bank officers and managers, INDSCAL attempts to find such a map from the respective groups' similarity matrices. The individual map for a particular group can then be derived from the common map by multiplying its coordinates by the square-roots of the dimension coefficients for that group (see Carroll and Chang, 1970; and Kruskal and Wish, 1978).

The final INDSCAL configuration results and the dimension coefficients for accountants, bank officers and managers are given in Table 2. The low badness-of-fit criterion (0.0638) suggests that a common perceptual map does in fact exist among the three groups, and that the final configuration is satisfactory. (The badness-of-fit criterion generated is a generalisation of Kruskal/Young's stress formula 1—SAS Institute, 1992:259). Based on the coordinates of the two dimensions in Table 2, the common perceptual map for accountants, bank officers and managers is plotted in Figure 1. The cluster analysis results (to be discussed in a later section) are also incorporated in Table 2 and Figure 1.

In deriving the final INDSCAL results, the configuration based on two dimensions is deemed the most appropriate for the following reasons. First, while the badness-of-fit criterion decreases substantially (from 0.1043 to 0.0638) when the number of dimensions is increased from one to two, the decrease (from 0.0638 to 0.0495) is much less when the number of dimensions is increased from two to three. Thus, the two-dimensional configuration can be considered a parsimonious model. Second, an examination of the three-dimensional configuration indicates that little new information is gained by adding a third dimension. In fact, there is the danger of over-fitting the model. Further, a two-dimensional solution has the advantage of ease of interpretation. Finally, an evaluation of the guidelines on the appropriate number of dimensions (see Jones and Koehly, 1993) suggests that a two-dimensional solution is most appropriate. For

Table 2
INDSCAL and cluster analysis results

	MDS configuration[1]		
	Dim 1	*Dim 2*	*Cluster membership*[2]
AM	0.76	0.25	1
AC	1.66	0.58	1
CG	−0.65	1.26	2
CL	−0.96	1.49	2
CE	−0.51	−1.84	3
EP	0.86	−0.83	1
FP	−0.51	1.08	2
HF	−1.99	−1.20	3
NM	0.72	0.21	1
OF	0.69	−0.26	1
RU	−0.78	−0.97	3
TF	0.71	0.23	1

Badness-of-fit criterion = 0.0638

		Dimension coefficients[3]	
	Accountants	*Bank officers*	*Managers*
Dim1 (Sqrt)	1.02 (1.01)	0.98 (0.99)	0.96 (0.98)
Dim2 (Sqrt)	0.98 (0.99)	1.02 (1.01)	1.04 (1.02)

Legend
AM = absence of material errors
CL = compliance with legal requirements
CE = correspondence with economic facts
EP = exercise of proper judgment
FP = full and proper disclosure
HF = healthy financial position/performance
NM = not misleading
OF = objective and free from bias
RU = relevant and useful
TF = true and fair
Dim1 = dimension 1 of the INDSCAL configuration
Dim2 = dimension 2 of the INDSCAL configuration
Sqrt = square root

[1] The numbers are coordinates of the different phrases on dimensions 1 and 2 of the MDS map (see Figure 1).

[2] The cluster number shows the identity of the cluster to which a phrase belongs (see also Figure 1).

[3] The square-root of these coefficients when multiplied by the INDSCAL coordinates give the individual MDS map for each group of respondents.

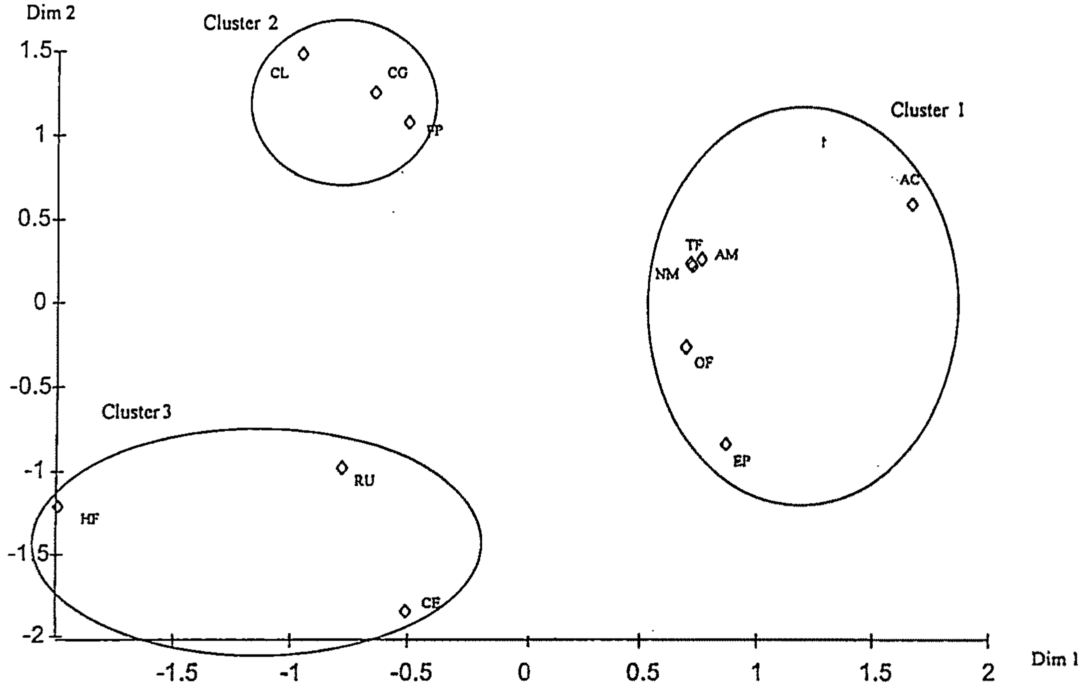
example, Kruskal and Wish (1978) suggest that the number of dimensions should not exceed [(n − 1)/4], where n is the number of stimuli. With 12 phrases in the present study, the number of dimensions should not exceed 2.75.

3.2. Interpretation and Implications of the INDSCAL Results

Generally, the resulting perceptual map can be interpreted in the following manner. The 12 points on the map correspond with the 12 phrases under investigation. The location of each phrase on the map is determined by its coordinates on the two dimensions; i.e., by its levels of dimension 1 and dimension 2. The proximity (distance) between two points on the perceptual map reflects the degree of similarity (dissimilarity) of the two corresponding phrases as perceived by the respondents. Thus, phrases close to 'true and fair' are perceived to be similar to 'true and fair' and phrases far away from 'true and fair' are perceived to be dissimilar to 'true and fair'. INDSCAL results are not unique in that the final configurations may be rotated, reflected, dilated and/or contracted. Thus, only relative (and not absolute) distances are meaningful. This characteristic must be borne in mind when interpreting the results.

To assess the perceived similarity/dissimilarity of the 12 phrases more objectively, cluster analysis is performed. Such an analysis aims to group

Figure 1
INDSCAL common perceptual map with clusters identified



Note: The interpretation of the abbreviations can be found in Table 1. This MDS map plots the INDSCAL configuration and summarises the cluster analysis results by drawing a boundary around phrases which belong to the same cluster.

homogeneous items into the same group, and heterogeneous items into different groups. That is, phrases in the same cluster are perceived to be similar to each other, but they are perceived to be dissimilar to phrases in other clusters. Cluster analysis results are incorporated in Figure 1 by drawing a boundary around members of the same cluster. For the study, the following methods of cluster analysis are explored: average, centroid, furthest, median and nearest. Also, two different metrics are experimented: the distances from the INDSCAL map (see Table 2 and Figure 1) and the original similarity matrix (where distance is defined as 1 minus the relative frequency in which the phrases are paired together). The results are consistent; thus, the clusters are not sensitive to the choice of method and metric.

From Figure 1 and Table 2, it can be seen that, collectively, the three groups perceive 'true and fair' to be very similar to 'not misleading' and 'absence of material errors'. They also perceive it to be similar to 'objective and free from bias'. To a lesser extent, 'true and fair' is also associated with 'exercise of proper judgment' and 'accurate and correct'. Further, 'full and proper disclosure', 'compliance with legal requirements' and 'compliance with GAAP' are perceived as very similar to each other, but they form an independent cluster that is distinct from 'true and fair'. Finally, 'relevant and useful', 'correspondence with economic facts' and 'healthy financial position/performance' form a separate cluster by themselves too.

The dimension coefficients for accountants, bank officers and managers are very close to one (see Table 2). As mentioned earlier, individual group maps can be derived by multiplying the INDSCAL coordinates on dimensions 1 and 2 by the square-roots of the respective dimension coefficients. As shown in Table 2, the square-roots of the dimension coefficients are also very close to one. In fact, t-test and Wilcoxon test results indicate that the square-roots are not significantly different from 1 (p-value = 0.9999). This implies that the perceptual maps for accountants, bank officers and managers are not significantly different from each other.

Overall, the INDSCAL results yield two important findings in relation to the research objectives. First, accountants', bank officers' and managers' cognitive structures and perceptions with respect to the true and fair view are very similar. That is, there is no significant differential perceptions of true and fair among these three groups. Apparently, the lack of definition for, and the ambiguity of, the true and fair view have not led to differential perceptions among respondents.

Second, despite previous suggestions by several authors (e.g., Hoffman and Arden, 1983; Walker, 1984, 1986; Rutherford, 1985, 1988; Walton, 1991, 1993; and Gearin and Khandelwal, 1995) that 'true and fair' should be interpreted with reference to compliance with GAAP and legal requirements, all three groups distinctly differentiate both types of compliance from 'true and fair'. In other words, accountants, bank officers and managers do not perceive true and fair to be associated with compliance with GAAP and legal requirements. Rather, they associate compliance with GAAP and with legal requirements with 'full and proper disclosure' (see Figure 1). Further, accountants, bank officers and managers perceive (and perhaps define) 'true and fair' essentially as 'not misleading', 'absence of material errors' and 'objective and free from bias'.

4. Conclusion

The objective of this study is two-fold. First, it assesses the perceptions of the true and fair view as held by accountants, bank officers and managers in Singapore. In particular, it investigates whether differential perceptions exist among the three groups. Second, it examines whether the true and fair view is associated with compliance with GAAP and with legal requirements. It is found that perceptions of the true and fair view do not differ significantly across the three groups. Further, 'true and fair' is not perceived to mean compliance with GAAP and/or compliance with legal requirements.

In interpreting the study's results, the following limitations should be noted. First, the survey questionnaire is a self-report instrument; hence, all shortcomings of such a methodology (e.g., non-response bias and response bias) apply. However, non-response bias may be mitigated by the high response rate (74%) in the study.

Second, while random samples of accountants, bank officers and managers are desirable, they are difficult to achieve. In the study, random sampling is applied to organisations only, but not directly to potential respondents. A certain degree of self-selection is present because of the study's voluntary nature. To the extent that the samples are not representative of their respective populations, the results cannot be generalised. Also, results applicable to accountants, bank officers and managers in Singapore may not apply to other populations, geographical regions or contexts. Replication of similar studies may enhance the findings' external validity.

Third, the results presented here may be dependent on the phrases included in the study. While the inclusion of more phrases may lead to more conclusive evidence, such an approach can make the task of evaluating the phrases extremely difficult and tedious for the respondents. Thus, a trade-off is involved. Further, the (alphabetical) order in which the phrases is presented to the respondents may induce bias in their responses. This, however, is mitigated by the fact that the respondents evaluate all the phrases simultaneously.

Finally, it is noted after the survey that 59 (i.e., 13%) of the 446 respondents used all the six columns provided. It is therefore possible that the results may differ if more columns were provided. However, such differences are not expected to be significant, since almost 80% of the respondents (354) used between three to five columns.

In this concluding section, it is appropriate to suggest directions for future research. For instance, using this paper's methodology, different subsets of phrases (e.g., 10 to 15 phrases per subset) can be tested and analysed to provide a better interpretation of the true and fair view. The stability of the results can also be tested with the different subsets.

Further, similar studies can be extended to different contexts (e.g., auditing context or investment context), populations (e.g., shareholders or lay users of financial statements) and regions (e.g., Asian countries or Commonwealth countries). Aggregating evidence across different contexts, populations and regions can contribute towards the true and fair view literature.

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UK Shareholders' Lost Access to Management Information

Ken C. Pratt and A. Colin Storrar*

Abstract—This paper examines the nature and use of the rights that UK shareholders once had to inspect their companies' books of account, and identifies seven factors that contributed to loss of those rights, mainly in the second half of the 19th century. It also considers whether those seven factors remain relevant today and might therefore inhibit a return to more open access to information. The paper concludes that, although each of the factors continues to apply to some extent, current levels of disclosure may be less than optimal because of subsequent developments in information technology and other changes in the operating environment. It argues, further, that financial reporting databases could help to improve the equity and utility of information disclosure, but are unlikely to be initiated voluntarily by preparers.

1. Introduction

Shareholders in the 18th and early 19th centuries were generally entitled to inspect their companies' actual books of account.[1] That privilege is no longer available, with the result that shareholders today have access to much less information about their investments, their power and control have been materially reduced, and decisions about the form and content of disclosures have in effect been delegated to managers and regulators.

There is increasing recognition that shareholders should be entitled to fuller information and that developments in information technology might be applied in providing it. For example, recommendations of the Research Committee of the Institute of Chartered Accountants of Scotland in *Making Corporate Reports Valuable* (McMonnies, 1988) include providing investors with the same sort of information as management (para. 7.2), reporting significant 'events' as they occur (para. 7.57), and the proposal that some of the reporting procedures 'would largely be carried out by means of the computer' (para. 7.58). The Cadbury Report recognises the advantage to users of reports and accounts of some explanation of factors likely to influence future progress (para. 4.53), and considers that boards may need to keep shareholders and the market more frequently in touch with their company's progress (para. 4.54).

Financial reporting databases could provide an effective basis for improvements in the quantity, frequency and timeliness of information. They could enable shareholders to satisfy their individual information needs by examining selected transactions or by processing company data through their own accounting systems (Beaver and Rappaport, 1984; Pratt, 1987; Cushing, 1989). Managers' accountability for the funds entrusted to them would be increased, and shareholders would be able to monitor their investments more effectively.

Few would seriously argue that shareholders should have access to *all* the information available within their company, as was theoretically the case in the 18th and early 19th centuries. Nevertheless, even within the bounds imposed by competitive disadvantage and information overload, there is scope for making more information available to shareholders, more frequently and more quickly than is currently the case. In the words of the ICAS Research Committee, 'the internal information has therefore to be carefully tailored so that the maximum useful knowledge is available to the external groups with a right to such knowledge without giving so much that the entity and its owners will be prejudiced' (McMonnies, 1988, para. 3.20).

This paper identifies a number of factors that contributed to the decline of proprietors' rights of access to their companies' books of account. It also considers whether those factors continue to have relevance to listed companies today and might therefore inhibit a return to more open access to information made possible by advances in information technology. Different systems of accountability, based for example on shareholders' rights to inspect books, distribution of accounting statements, audit, remote access to financial reporting databases, and permutations of these, will have different costs and benefits. These may also differ for each individual. This paper does not attempt to assess economic feasibility or the effects of each factor on social choice of a system of accountability. Indeed, it may be argued that such an assessment would be impossible.[2]

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*The authors are, respectively, senior lecturer in the Department of Accountancy and Finance at the University of Stirling and lecturer retired from that department. They are indebted to Professor William McInnes and Dr Vivien Beattie for comments on earlier drafts of the paper. An academic award from The Scottish Chartered Accountants' Trust for Education, enabling the authors to present a version of the paper at the 17th Annual European Accounting Association Congress, 1994, is gratefully acknowledged. The paper has benefited from comments received at that congress and at the British Accounting Association National Conference, 1995. Comments and suggestions by two anonymous reviewers have also made a significant contribution to the paper. Correspondence should be addressed to Mr K. C. Pratt, Department of Accountancy and Finance, The Faculty of Management, University of Stirling, Stirling FK9 4LA. This paper was submitted in September 1995 and accepted in February 1997.

[1] The term 'books of account', which had previously been used in British Companies Acts, was replaced by the term 'accounting records' in the 1967 Companies Act. (See, for example, Parker, 1989:106–107 and Parker, 1990:61–62.)

Evidence used in the study includes relevant statutes, reports and minutes of government committees and other early sources.[3] The study concentrates mainly on the period from around 1840 to the end of the 19th century, during which shareholders' rights of access to accounting records largely ceased to be effective. Earlier evidence is also cited to show that some contributory factors had a much longer provenance.

The remainder of the paper is organised as follows. The next section examines the origins and provides evidence of the rights that shareholders at one time had to inspect their companies' books of account and other records. The subsequent section examines the extent to which shareholders exercised those rights. The main section of the paper identifies factors that may have contributed to the loss of rights of inspection of books of account, and considers whether they still apply. The final section summarises the paper's main findings and conclusions.

2. Origins and evidence of rights of inspection

Until at least the middle of the 19th century, shareholders were considered to have an inherent right to inspect their companies' books of account. The origin of this right lay in the legal descent of the joint stock company from the earlier partnership form. As recently as the early 20th century, even after the important judgment in *Salomon v Salomon & Co* [1897, A.C. 22, H.L.] confirming its separate legal identity, the limited company was still regarded as a modified form of partnership. For example, the entry for 'Auditing' in Lisle's *Encyclopaedia of Accountancy*, published in 1903, states that 'For all essential purposes...a joint stock company is a partnership, and the rights of its members are the rights of partners *inter se*, save as specifically limited...' (Dicksee, 1903, in Lisle, Vol. 1: 169). A contributor to *The Accountant's Magazine* in 1904 expresses the opinion that:

> 'Joint stock companies are just large partnerships, with some differences; principally, so far as we at present are concerned, that the great majority of the members or shareholders are just sleeping partners, the right of management being confided to a body of directors...' (Kennedy, 1904:540).

Limited companies in the 19th century fell into two main groups: statutory companies (including chartered companies) and registered companies.[4] Until at least the 1880s, statutory companies were more significant than registered companies in the British economy, and therefore for the development of company accounting and reporting (Edwards, 1980, Vol I: vii; Edwards and Webb, 1985:179; Parker, 1990:52–54). Common examples were canal and, later, railway companies, and companies for the supply of water, gas and, eventually, electricity to major towns. The formation of statutory companies required individual Acts of Parliament, each with its own accounting requirements and other regulations as the promoters and legislators thought fit. In the 1840s, however, 'Clauses Acts', particularly the Companies Clauses Consolidation Act of 1845,[5] 'assembled in one statute the most common provisions' that companies could then adopt by reference (Parker, 1990:59–60).

Almost all joint stock companies were statutory companies until 1844, when the Joint Stock Companies Act of that year for the first time permitted companies to be incorporated, although with unlimited liability, by a relatively informal registration procedure. The right to limited liability was permitted by an Act of 1855 and confirmed in the Joint Stock Companies Act of 1856 (s. 110) and the Companies Act of 1862 (s. 7).

Gower (1992) argues that the introduction of limited liability 'finally established companies as the major instrument of economic development'

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[2] See Arrow (1963). Bromwich (1992:258–260; 275–277) provides a brief review and discussion in an accounting context.

[3] A considerable debt is owed to Professor J. R. Edwards, whose edited collections of source materials (1980 and 1986) are an invaluable aid to research on this period in the development of company regulation in the UK.

[4] For a discussion of the different forms of company, the relevant legislation and implications for the development of financial reporting, see Edey and Panitpakdi (1956:356–379), Parker (1990:51–71), Edwards (1992:59–73) and Gower (1992:3–54).

[5] The main Acts referred to in this paper are the Joint Stock Companies Act 1844 (7&8 Vict., c.113), Companies Clauses Consolidation Act 1845 (8&9 Vict., c.16), Limited Liability Act 1855 (18&19 Vict., c.133), Joint Stock Companies Act 1856 (19&20 Vict., c.47), and the Companies Acts of 1862 (25&26 Vict., c.89), 1867 (30&31 Vict., c.131), 1907 (7 Edw. 7, c.50), 1908 (8 Edw. 7, c.69), 1929 (19&20 Geo. 5, c.23), 1948 (11 & 12 Geo. 6, c.38) and 1985 (c.6).

Figure 1
Extracts from Table A articles relating to inspection of records in Companies Acts of 1862, 1908 and 1985

Companies Act, 1862, Table A, article 78

'The Books of Account shall be kept at the registered office of the Company, and subject to any reasonable restriction as to Time and Manner of inspecting the same that may be imposed by the Company in General Meeting, shall be open to the Inspection of the Members during the Hours of Business.'

Companies (Consolidation) Act, 1908, Table A, article 105

'The directors shall from time to time determine whether and to what extent and at what times and places and under what conditions or regulations the accounts and books of the company or any of them shall be open to the inspection of members not being directors, and no member (not being a director) shall have any right of inspecting any account or book or document of the company except as conferred by statute or authorised by the company in general meeting.'

Companies Act, 1985, Table A, article 109

'No member shall (as such) have any right of inspecting any accounting records or other book or document of the company except as conferred by statute or authorised by the directors or by ordinary resolution of the company.'

(p. 47) and that 'the profusion of sections and schedules relating to company accounts in the current Companies Acts resulted from the recognition that the price of limited liability ought to be the maximum possible disclosure of information regarding the company's financial position' (p. 453). An example of a different point of view, however, is that of Henry Burton Buckley QC, who told the Select Committee on the 1895 Bill:

> 'I do not myself see any ground of principle upon which persons who are trading with limited liability should be under an obligation to disclose their accounts which a private trader is not under' (BPP, 1898, minute 1661).

Both the 1844 and 1845 Acts included accounting, reporting and auditing requirements (ss. XXXIII *et seq.* and CXV *et seq.* respectively). In addition to the obligation to prepare audited balance sheets, both Acts authorised shareholders to inspect the books of account during the weeks before and after general meetings (ss. XXXVII and CXVII respectively). This annual, or sometimes semi-annual, open season for shareholders' inspection actually represented a restriction of the common earlier right of general access to the books. Thus, similar clauses in the acts of incorporation of two canal companies, in 1732 and 1766, provided that 'Every Proprietor upon every reasonable desire [was] to have access to the Books for his Inspection' (DuBois, 1938:339). In 1769, the general assembly of the Birmingham Canal Navigation resolved that the bookkeeping clerk 'attend the Navigation Office every day from ten to one o'clock in order to show any books and papers under his charge to any Proprietor who may require to see the same' (ibid). The act incorporating the Glamorganshire Canal Company (1790) granted proprietors 'free access' to the books 'at all seasonable times', while that for the Surrey Iron Railway Company (1801), in almost identical wording, permitted access 'at all reasonable times' (Edwards, 1986, Vol I: 2 and 4).

The continuing importance attributed by Parliament to such rights of access enjoyed by the shareholders of statutory companies was emphasised as late as 1849 by the Select Committee on the Audit of Railway Accounts[6] (BPP, 1849, Third Report: x). Nevertheless, in a retreat from regulation reminiscent of our times, the 1856 Act transferred the reporting and inspection requirements for registered companies from the body of the Act to the optional Table B,[7] to apply only in cases where a company's Articles of Association were silent or inadequate on these matters. For the remainder of the century there were no compulsory accounting, reporting or audit requirements for registered companies as such, although regulations remained or were introduced for particular industries such as banking, railways and insurance (Edwards, 1992:59; Parker, 1990:59–64).

Figure 1 summarises provisions relating to inspection of books or records in the Companies Acts of 1862, 1908 and 1985. Parker (1990:61–2) observes that the wording in the 1862 Act makes shareholder inspection sound normal, while that in the 1908 Act makes it sound abnormal. The 1908 paragraph was retained in the 1929 and 1948 Acts, but the rights of inspection are denied under Table A of the 1985 Act unless specifically provided.

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[6] The Reports and Minutes of Evidence of this House of Lords Select Committee are an important source of views and comments recorded during a formative period for accountability and financial reporting in the UK. For brevity, the frequent references in this paper are to 'the 1849 Select Committee'.

[7] Table B of the 1856 Act became Table A in the 1862 and later Companies Acts.

The changing attitude toward shareholders' rights of inspection during the second half of the 19th century is well illustrated in the study by Edwards and Webb (1985) of the extent to which Table A of the 1862 Act was adopted by 30 newly-incorporated companies in the iron and steel industry between 1862 and 1900. Fifteen of the 30 companies were established between 1862 and 1880, and the remaining 15 between 1880 and 1900. As indicated in Figure 1, Article 78 of Table A in the 1862 Act provided that the books of account should be kept at the company's registered office and 'subject to any reasonable restrictions' should be open to inspection by members during the hours of business.

From the findings set out by Edwards and Webb (p. 183) it may be concluded that, during the earlier period, the alternative articles adopted in place of Table A restricted shareholders' access to the books of account in only four cases: in two instances inspection was only allowed during the period around the date of the annual meeting, and in two only shareholders owning a specified minimum number of shares were granted access to the books.

By contrast, in the period after 1880 no fewer than 11 of the companies only permitted access to the books 'with the authority of the board, the general meeting or by statute', thus significantly limiting the effectiveness of the right as a check on the directors.

By the 1880s, therefore, at least as far as newly-incorporated companies were concerned, it appears that it was common practice for the articles to restrict significantly the right of inspection—a right an earlier generation had considered essential.

3. Exercise by shareholders of rights of inspection

It is difficult to establish the extent to which shareholders, at any period, actually exercised the right to inspect books of account, although early references provide some limited evidence. A minute of the Court of Directors of the South Sea Company in 1735, for example, records: 'The Accomptant....acquainted the Court that some few proprietors had been at his office and had looked into the accompts but did not communicate to him any observations thereon' (DuBois, 1938:302).

More specific evidence is available for the 1840s. Several witnesses to the 1849 Select Committee concurred that shareholders had not exercised their rights in earlier good times and had only taken an interest in their companies during the recent crisis.[8] Asked whether 'there was a strong disposition in the general body of proprietors to look very closely into the details of their affairs', the chairman of the Great Western Railway Company (Charles Russell) replied: 'I should say that recently there has been such a disposition' (minute 2014). Asked if this had been the case 'when railway matters were in a flourishing condition' he told the Committee that 'When railway property was returning 10 per cent dividends, unquestionably shareholders were contented, and did not exercise the same kind of control that they do now' (minute 2015). John Swift, solicitor to the London and North Western Railway Company, advised that before buying shares in railway companies, 'I should examine the books, which the shareholders have not generally done, though they have power to do it fully enough' (minute 2503).

Several witnesses were asked whether the enactment of a statutory right of inspection gave adequate security that the accounts were duly kept and that all the entries in the books were bona fide. Sir John Easthope, a former director and chairman of the South Western Railway Company, replied: 'I think it is good as far as it goes, but it is by no means adequate' (minute 2706). A similar view was expressed by John Bagshaw, a Member of Parliament and director of the Northern and Eastern Railway Company, who added: 'and further than that, it is found to be so inadequate, that no one really takes the trouble to apply for the purpose' (minute 2929).

There is a good deal of evidence of difficulties encountered by shareholders in attempting to exercise their right of inspection. The First Report of the 1849 Select Committee, dealing mainly with the North Wales Railway and in particular with illegal loans, refers to shareholders' attempts to inspect books of account as follows:

> 'The most vexatious difficulties and excuses were interposed to prevent any effectual inspection; and when inspection was at length permitted, it was discovered that these loans were entered in the ledger in cipher....' (p. x).

A former secretary of the company (John Marriner) acknowledged that the accounts had thus been kept 'in such a manner as to be utterly unintelligible to a person who inspects them' (minute 491). The company's chairman (William Chadwick), asked whether he could conceive that such accounts were 'duly kept', conceded: 'No, I do not think it justifiable at all...' (minute 269). In addition, certain papers had been torn out of the company's journal (minutes 431 and 633, inter alia).

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[8] A reference to the 'Railway Mania'. (See, for example, Lewin, 1936; Evans, 1849:1–52.)

A Caledonian Railway shareholder (William Dockar) told the Committee that the books produced to the visiting shareholders comprised only the general ledger and the journal, while a subsidiary book 'explanatory of the entry, which we could not otherwise make out' was withheld (minute 3154). The company's chairman (John James Hope Johnstone) conceded that commercially sensitive data had been omitted, temporarily, from the books (minutes 3576 and 3577).

Shareholders whose efforts to inspect the books had been frustrated had little effective recourse against their company. A contemporary description of 'the leading regulations under which the Financial Affairs of Railway Companies are for the most part conducted' includes the following explanation:

> 'It is required that [the] Books and Balance-sheet shall, at times specified, be open to the inspection of the Shareholders, who are permitted to take copies or extracts, and that the Book-keeper shall be bound to permit such inspection, under a penalty of £.5 (sic) for every refusal or neglect. It is here observable, that no penalty is by law imposed upon the Directors for any violation of this enactment, even though the Book-keeper, who is their servant, may have acted under the special orders of his employers' (BPP, 1849, Third Report: iii).

One of the problems facing investigating shareholders was the practice of appointing as officers, such as company secretaries, nonentities whom it was fruitless to pursue by legal action. Thus one witness, engaged in the collection of railway information 'for the exclusive benefit of the Stock Exchange', agreed that the absence of a penalty imposed on the directors might 'lead to the possibility of naming a man of straw as the officer of the Company who may or may not disappear after the refusal has taken place, leaving the shareholder, who has been deprived of his statutable (sic) remedy, without any means of enforcing the requirement of the law' (Mihill Slaughter, minute 1143). Another witness from whom accounts had been withheld (John Herapath, minutes 660–663), said that the only remedy was to summon the officer before the Lord Mayor. The officer in this case had been the secretary, who had since resigned.

The Select Committee recognised that the right of inspection had on occasion proved difficult or even impossible to exercise, and proposed that the directors be held more accountable thus:

> 'The Committee attach high importance to the privilege of inspecting the Accounts of the Company, granted to the Shareholders. But this right of inspection should be unrestrained; all Accounts, without exception, touching or relating to the Receipts and Payments of the company should be required to be produced; and in case of refusal or neglect, the Directors should be made responsible for the default of their own officer, and the statutory penalty should be extended from the Book-keeper to the governing body' (BPP, 1849, Third Report: x).

By the middle of the 19th century, the intention of legislators in granting to individual shareholders the right to inspect their companies' books of account was regularly frustrated in practice. After 1849, little further attention was given by government or its committees to individual rights of inspection. The attention of reformers turned instead to other forms of shareholder protection, principally collective rights to receive adequate financial statements on which the directors could be questioned at annual general meetings. It is noteworthy that witnesses to the Select Committee on the Operation of the Companies Acts 1862 and 1867 (BPP, 1877) did not raise the question of direct access by shareholders to books of account; the discussion instead dealt almost entirely with the submission of balance sheets and sometimes profit and loss accounts to shareholders. A prominent witness, Sir George Jessel, Master of the Rolls, still considered that directors should not be compelled to issue accounts which shareholders could themselves call for if they wished (minute 2192; see also Parker, 1984:81).

Audited financial statements are of course an essential feature of the current system of accountability. Many shareholders may make little use of them, but according to Ijiri (1983:78):

> 'What is important is the usefulness of the accounting system as a whole and not necessarily the usefulness of the accounting information itself. The accounting system can be highly useful to the accountor and the accountee even if no one reads the accounting reports. Like insurance, what is ultimately of use here is the assurance provided by an accounting system of records and reports that things can be accounted for whenever necessary. If the accountor behaves more accountably and the accountee increases the trust on the accountor because of the existence of records and reports, that benefit of the accounting system is of fundamental importance even if neither party reads the records or reports.'

As we have seen, until the mid-19th century, the right of shareholders to inspect books of account, whether or not it was widely exercised, was considered an essential component of the system of accountability. Today that right no longer exists.

4. Factors contributing to the loss of rights of inspection

This main section of the paper identifies factors that seem to have contributed to the loss of rights of inspection, and provides supporting evidence from contemporary sources. Consideration is also given to the extent to which each contributory factor remains relevant today, and may therefore continue to militate against renewed access to more of the accounting information available internally.

4.1. Number and Dispersion of Shareholders

The accepted opinion that proprietors and other interested parties should be given access to accounting records, rather than, or as well as, to financial statements, may have persisted well into the 19th century on 'an implicit assumption that shareholders were few in number' (Parker, 1990:60–61). In due course, however, the increase in the numbers of shareholders must have made it difficult to maintain those rights. Membership of 18th century enterprises was typically small, but the 19th century saw a major expansion of investment by the general public in company shares. (See, for example: Hirst, 1911:51; Evans, 1936, chaps. II and III; Morgan and Thomas, 1962:108.)

Most investors in early enterprises lived close to their company and so were in a position to take advantage of rights of access to their companies' books. For example, over 90% of transfers by an Edinburgh stockbroker in the period 1833 to 1836 were in 'joint-stock concerns operating in Edinburgh and its area, while another 8% were located in the rest of Scotland' (Michie, 1981:73). A high level of local subscription was considered a prerequisite for a parliamentary charter for railway companies (Baskin, 1988:209). Canal and railroad securities were sold primarily in local markets until the 1840s, the principal shareholders being 'not London financiers but investors from proximate areas who were more familiar with the potential benefits' (ibid: 211). The preponderance of local shareholders sometimes also arose 'simply from the populace's desire to promote local civic improvements' (ibid: 212). Shareholders in canal and railway companies were often local merchants seeking improved transport, and other local individuals taking shares from 'a feeling of community obligation' (Evans, 1936:6).

The Select Committee on Investments for the Savings of the Middle and Working Classes suggested that the savings of those classes might be invested in projects 'likely to yield a reasonable interest within the counties where the parties lived; within their view and under such regulations as might prevent fraud...' (BPP, 1850).

In time, however, shareholders became more widely dispersed. Investors who had been successful in local ventures sought to extend this success in other areas. Baskin (1988:212), for example, notes that following the highly profitable linking of the port of Liverpool with Manchester in 1830, investors from these cities subsequently played an important role in railroad development throughout England. Thus Reed (1975:87) shows that during the 1830s the prospectuses of railways far distant from Lancashire were advertised in Liverpool and Manchester newspapers. The Edinburgh and Glasgow Railway failed to attract sufficient local investment and only got going with English capital. It is estimated that only one-third of the company's shareholders were Scottish (Michie, 1981:57; 66).

The greater geographical spread of ownership made it more difficult for many to take advantage of rights of access to their companies' books. William Frederick Spackman, an expert witness on railway business, told the 1849 Select Committee:

> 'I am aware that the books and accounts of Railway Companies are open at stated periods to the inspection of the shareholders, but the constituency of a company reside in all parts of the three kingdoms, and very few indeed have any opportunity of making such an inspection...' (minute 1283).

Edwards and Webb (1985:183) observe that 'as the average size of iron and steel companies increased during the second half of the nineteenth century, the shareholdings became more widely dispersed and it was no doubt impractical to allow members the freedom of access anticipated by the model provision'. They also consider that where the business activities were spread over a wide geographical area 'it is probably unreasonable to expect the books of account to be entirely located at the registered office'.

Financial statements provided some information and protection to shareholders who could not readily inspect books of accounts themselves. Although the investment community today is international, the wide dispersion of its membership places little constraint on more open access to information. If that information were to be made available to them on networked databases, shareholders would be able to use it at any time and place they chose.

4.2. Financial Sophistication of Shareholders

The extent to which shareholders could make effective use of access to books of account was affected by two trends that were particularly significant in the period under review: a growing community of new and inexperienced investors, and the increasing size and complexity of companies and their operations.

Prior to 1800, participation had been confined mainly to the relatively wealthy members of society. Shareholders were 'usually composed of either the landed interest, merchants, or professional people such as lawyers, physicians or ministers' (Michie, 1978:154). For example, although perhaps an extreme case, the list of initial subscribers to the Forth and Clyde Navigation in 1768 included six dukes, two marquises, 17 earls, two lords, 15 baronets or knights, an admiral, a major-general and three colonels (Forrester, 1980: III/6 and Appx. B). Investors from these classes might be expected to have, or have access to, an understanding of financial matters.

In contrast, an article in *The Economist* of 28 June 1845 remarked, with perhaps a measure of exaggeration: 'Everybody is in the stocks now. Needy clerks, poor tradesmen's apprentices, discarded serving men and bankrupts—all have entered the ranks of the great monied interest' (cited by Morgan and Thomas, 1962:108). The secretary of the Great Western Railway is described as 'canvassing' in the South Wales and Gloucestershire area in the winter of 1834–35, 'calling upon and pressing perfect strangers to contribute' (Reed, 1975:82–83). In evidence to the 1849 Select Committee, Mihill Slaughter refers to 'common tradesmen and persons in the humbler walks of life' who were ordinary shareholders (minute 1107). The Committee recognised that many of these would have relatively little experience of business or understanding of books of account:

> '[T]he majority of Shareholders are not always parties who possess the peculiar knowledge required for the examination of Accounts extending to millions, and including heads of complicated disbursement, not very intelligible to any but persons experienced in such inquiries' (BPP, 1849, Third Report: x).

Asked by the Committee whether there were demands for more complete accounting statements, the chairman of the Great Western Railway (Charles Russell), replied:

> 'There were. Some people fancy that accounts of this sort shall be reduced to the simplicity of their weekly accounts like butchers' and bakers' bills. Now, when you consider the vast magnitude of these concerns, I believe the real way to make their accounts intelligible to the public is to condense them. If once you go into elaborate detail you will only confuse them' (minute 1907).

The financial sophistication of users continues to be an important issue in modern financial reporting. Lee and Tweedie (1977:130–31) found that a considerable communications gap existed between companies and their private shareholders. 'Non-accounting' respondents to their survey rated the chairman's report as the most popular section of the annual report and tended 'to steer clear of major statements containing large quantities of quantitative data'. The Accounting Standards Board (1993:4) recommends an Operating and Financial Review 'to be readily understandable by the general reader of annual reports'. The Cadbury Report (1992, para. 4.58) notes that 'the demand for an ever-increasing amount of detail in reports and accounts has to be weighed against the need for them to be understandable by the reasonably informed shareholder'. Simplified forms of report 'allow boards to address shareholders who would prefer such a statement'.

Financial reporting databases could provide information in a variety of forms, including management commentary and summary accounting statements for the less sophisticated investor, and the 'ever-increasing amount of detail' for institutional and larger, more sophisticated private investors who prefer to have more information.

4.3. Time Required to Examine Accounting Records

Even if shareholders were within a reasonable distance of their company and had an adequate understanding of books of account, a thorough inspection would require an increasing commitment of time as higher volumes of transactions accompanied growth. John Bagshaw, an MP and former deputy chairman of the Northern and Eastern Railway, agreed with a member of the 1849 Select Committee that shareholders' rights of inspection amounted to 'but little more, in many cases than exhibiting a great weight of books, and a mighty farrago of figures, from which a shareholder would find it extremely difficult to deduce the true profit and loss of the company' (minute 2930). George King, formerly secretary to two railway companies, the Chester and Holyhead and the Birmingham and Gloucester, commented that shareholders inspecting 'merely see a large mass of figures upon two sides of the account through a set of immense books, and it is impossible that they can follow them...' (minute 2763). A contemporary estimate of the time it might have taken a sophisticated user to examine the books, and of the value of that examination, is given by John Swift, the solicitor for the London and North Western Railway Company (minutes 2545 and 2546):

> 'Q: You have said that if the shareholders were to exercise the power of scrutiny, which you say they have, they would be able to make a satisfactory examination into the affairs of the Company; would not that scrutiny take more time and require more knowl-

> edge than any shareholders are likely to possess?
> A: No, I do not think so at all; any public Accountant of intelligence could do it in six weeks; there are six weeks to do it twice a year; there is a fortnight before the meeting and a month afterwards; that is 12 weeks in the year.
> Q: Do you think that the best public Accountant, supposing him to have no previous knowledge upon the subject, could, by inspecting the books, in six weeks come to an exact knowledge of the affairs of the London and North Western Company?
> A: I do not think that he could in six years; and if that be so, the supposed audit could be of no use for the same reason: only the Directors and officers can know all about the affairs of the company.'

Financial statements prepared by those having the benefit of full inside knowledge, if attested independently, would appeal to many shareholders as a practical alternative protection to their own inspection.

However, a shareholder need not conduct a full examination to benefit from access to company records. He may instead want to have details of only a few transactions for a specific purpose. In the days of manual accounting records, this would involve opening the ledger at the relevant accounts and identifying entries of interest by scanning the pages. In similar circumstances today, an experienced user of database enquiry facilities could quickly retrieve data that meets his selection criteria. It is likely that access time would compare favourably in a modern database with that of manual access to a ledger, despite the much greater volume of transactions in a large company today. The collective efforts of many shareholders assessing different information would afford a high degree of accountability.

Selective access to information might be used, for example, to adjust published accounts to a different basis. In some other cases, a shareholder may wish to prepare his own accounting statements rather than adjust those published by the company. When records were maintained manually this would seldom be practical, except for very small companies. Even today, with records maintained on computer systems, few users would find it practical to prepare their own financial statements or to make substantial amendments to those provided. However, large institutional investors with interests in many companies may have both the will and the resources to do so. If financial reporting databases conformed to common standards, an institution could develop a computer system to extract data and prepare its preferred information quickly and economically. Repeated access to many company databases might justify the cost and effort incurred in developing the system.

4.4. Development of Markets for the Transfer of Shares

The development of more sophisticated markets for the transfer of shares probably reduced any reliance that shareholders were inclined to place on their rights of inspection. Previously, shareholders were more 'locked in' to their investments because it was not easy to sell shares quickly, and because they had a close association with and sense of responsibility to the company and their fellow members. In terms of Hirschman's framework (1970), the courses of action available to disenchanted shareholders, at least in the short term, were either 'loyalty', remaining faithfully silent, or 'voice', expressing their dissatisfaction to the management. However, the development of stock markets made it increasingly easy to sell their shares almost on a whim, providing shareholders with an 'exit' option (ibid.), which would appeal to many as a simpler and more effective remedy.

In their famous analysis, first published in 1932, Berle and Means (1967:247) comment as follows on the circumstances and behaviour of the 20th century shareholder:

> 'The net result of stripping the shareholder of virtually all his power within the corporation is to throw him upon an agency lying outside the corporation itself—the public market. It is to the market that most security holders look both for an appraisal of the expectations of their security, and by a curious paradox, for their chance of realizing them.'

Thus greater market efficiency not only increased the liquidity of the shareholder's investment, but also provided an increasingly reliable source of information on the value of his shares. For companies that are listed in a market that is assumed to be efficient, 'ordinary investors can accept prices as given, and their personal interest in the contents of the financial report may be substantially confined to the stewardship aspect' (Keane, 1980:4).

Securities markets did not attain their present level of efficiency overnight. Rather, it has been a gradual process over an extended period as 'the practices and institutions observable today' were developed to overcome limitations imposed by asymmetric information and a lack of investor confidence (Baskin, 1988:200).

In the 17th and 18th centuries, dealings in stocks and shares were transacted in alleys and coffee houses in London and other cities (Hirst, 1911:43–44; Morgan and Thomas, 1962:67–68). Potential buyers contacted were not necessarily all those interested in the shares (Michie, 1978:161), so exchange prices might not at that time have been good indicators of the securities' worth.

Improvements in communications have made a major contribution to the efficiency of securities markets today in comparison with, for example, the situation described by Poley (1920:12):

> 'At a time when the telegraph was unknown, and communication abroad uncertain, in any case involving delay, false reports often raised or depressed the market. Nevertheless, praiseworthy efforts were made and expense incurred by the great financial houses of the day to obtain intelligence. A highly organised secret system of transmitting news undoubtedly existed during the Napoleonic wars. To obtain early and truthful tidings of important events meant certain wealth to the fortunate possessor of the knowledge.'

The mid-1820s 'saw a great outburst of speculation which found vent in the flotation of many joint-stock projects' (Hirst, 1911:52), while in the mid-1840s the notorious 'Railway Mania' witnessed the flotation of many more new projects. In 1845, some 280 different kinds of railway shares were quoted in the Stock Exchange's official list, but by December 1849 this had fallen to 160 (Poley, 1920:12). According to the *Railway Times* of 30 September 1849, 'the distrust of railway property became such that towards the autumn of 1849 large masses of it were practically unsaleable' (cited by Poley, op. cit: 14). Share prices, even of the more sound companies, were subject to considerable fluctuations (Hirst, 1911:63).

More informed press commentary played a part in improving the market. According to Hirst, 'the swindling and blundering which marked the flotation and management of British railways in those early days were gradually corrected by the criticisms of a few honest and competent journals' (op. cit).

Even in today's highly developed stock markets, there is scope for increased efficiency:

> 'The lifeblood of markets is information and barriers to the flow of relevant information represent imperfections in the market...The more the activities of companies are transparent, the more accurately will the securities be valued' (Cadbury Report, 1992, para. 4.48).

4.5. Delegation of Inspection

From the earliest days of joint stock companies it was obvious that widespread exercise by individual shareholders of their powers of inspection would be disruptive, time-consuming and inefficient, so that some form of cooperation and delegation was likely to evolve. Delegation of the universal right of inspection developed in two directions: firstly toward the modern audit, and secondly into the official Board of Trade inspection on the demand of a sufficient minority of shareholders.

At least as early as the 1760s there were examples of committees of shareholders meeting regularly to inspect the accounts (DuBois, 1938:300 and 334, n. 135; Forrester, 1980: iii/9). In time, these 'audits' by representative shareholders elected by their colleagues, sometimes assisted by professional accountants, became an accepted means of accountability to proprietors, and they were required for both statutory and the new registered companies by the Acts of 1844 and 1845. The latter specifically granted to shareholder auditors the power to employ accountants; this power was exercised in 1849, for example, by the auditors of the Great Western Railway who sought the assistance of William Welch Deloitte, a prominent practising accountant.

To at least some contemporaries, this type of audit was seen as an inadequate substitute for the right of individual inspection. In his evidence to the 1849 Select Committee, John Swift, solicitor to the London and North Western Railway Company, said of 'the power of enquiry':

> '....that power will always save the shareholders; the shareholders at present have it, and, I think, are much more likely to exercise it zealously than they ever have done... .[I]f that power was duly and freely exercised, more good would come of it than of any audit' (minutes 2610 and 2611).

The 1856 Act (s. XLVIII et seq.) introduced provisions for Board of Trade inspections on application by a specified number of shareholders. Edwards (1980, Vol I: xiv) suggests this could be considered a substitute for the annual audit. It might also have been regarded by shareholders as a substitute for their own individual inspection.

The audit committee of the 1990s may be seen as a revival of the concept of audit by shareholders' committees. The Cadbury Report (1992) recommends that all listed companies should establish an audit committee (para. 4.35). Membership should be confined to non-executive directors. The committee should have full access to information, should be able to obtain external professional advice, and should be authorised to seek any information it requires from any employee (para. 4.35(d) and Annex para. 7).

Implementing these recommendations may help to restore some of the powers once enjoyed by committees of shareholders, although they are likely to be less effective as a means of ensuring the directors' accountability. While the earlier committees of inspection were appointed by the shareholders, the new audit committees are appointed by boards of directors. The more open access to information offered by financial reporting databases would go some way to restoring the position in which the principal inspection was delegated to auditors, while shareholders nevertheless retained some rights of personal inspection.

4.6. Competitive Disadvantage

There has been a long-running debate between those who advocate full and frank disclosure and those who consider it necessary to maintain confidentiality. The case for full disclosure has been urged since at least the 1750s. DuBois (1938:339, n. 158) cites the following passage from Postlethwayt's *Universal Dictionary of Trade and Commerce*, published in 1757:

> 'I must confess that I have not discernment enough to discover why the Books and Accounts of Trading Societies any more than those of the public Offices when the Stock of the national Revenue is registered should be kept private when the interest of the Public requires otherwise.'

Nearly a century later, a series of minutes (1280–1284) of the Select Committee on Joint Stock Companies (BPP, 1844) shows that the committee member asking the questions, as much as the witness providing the answers, favours a high degree of openness and accountability:

> 'Q: You think a disclosure of the way in which the money of the company has been employed, would, under no circumstances, be disadvantageous?
> A: None whatever.
> Q: Is not every shareholder who is a partner in the concern entitled to know all its affairs?
> A: Unquestionably, as a partner.
> Q: Does not the circumstance of a company, consisting of a great number of shareholders, almost compel that the affairs shall be made public?
> A: Certainly it does; necessarily if the shareholders chose to investigate their own affairs.
> Q: Then, is not the evil which is anticipated by some of the questions which have been just put to you, an evil inherent in the existence of joint stock companies?
> A: Yes.
> Q: Is not the evil of that publicity less than the evil of not permitting the partners in the concern to have easy access to a knowledge of the affairs of the concern?
> A: I think much less.'

Ironically, however, the desire for full disclosure did not extend to the name of the witness himself, referred to only as 'C. D. Esq.', a partner in a company of merchants.

As we have seen (supra), in the decades after 1850 shareholders were increasingly unable to gain access to their companies' books of account. As registered companies gained importance in the economy, there was a tendency for shareholders to be denied any financial information, even balance sheets, on the ground that they might be used to advantage by competitors.

Although the tide of public opinion had begun to turn towards greater accountability to shareholders by the end of the 19th century, and their right to receive and inspect an annual balance sheet had been re-introduced in the Companies Act of 1907 (s. 19), it was not until much later in the 20th century that the modern case for disclosure to shareholders was fully accepted. Thus in 1944 the Cohen Committee on Company Law Amendment recognised that if there were to be any flexibility in the law there would be opportunities for abuse, and considered that 'the fullest practicable disclosure of information concerning the activities of companies will lessen such opportunities and accord with a wakening social consciousness' (p. 7).

More recently still, Baxter has been an eloquent proponent of full disclosure. In a memorandum included in evidence to the Jenkins Committee (1962) he argued, with respect to a free economy: 'The society that fails to provide itself with the best available information is wasting resources and keeping its income needlessly low' (Appendix VII, para. 4). He considered an important argument for full disclosure to be 'the desirability of showing up managerial incompetence' (para. 5) and suggested that 'fear of publicity is somewhat ill-founded; American companies flourish despite candid accounts, and public confidence in business is probably far greater now than when secrecy was common' (para. 7).

The principal argument of those opposed to full disclosure has been that of competitive disadvantage. The risk that competitors might gain from the disclosure of information about a business has existed since the beginnings of enterprise, but increased significantly during the period under review. When the number of proprietors in an enterprise was small and most were actively involved in the business, each proprietor would have a greater sense of identity with his company and might derive a significant part of his income from it. A proprietor who failed to maintain confidentiality of information was at risk of being identified and so perhaps of losing his reputation and source of income. As the numbers of shareholders increased and the average size of shareholding decreased, so the active identification of shareholders with 'their' companies was reduced, and the risks and penalties of 'disloyal' behaviour became almost negligible.

A repeatedly-expressed concern was that a competitor could easily become a shareholder to gain access to information. For example, in evidence before the 1877 Select Committee on the Operation of the Companies Acts 1862 and 1867, a witness (David Chadwick) comments that 'the greatest enemy of the company...might make himself a shareholder in a single day, and then you might as well publish the balance sheet' (BPP, 1877, minute 1960). A similar point was made almost 30 years later in 'Suggestions Submitted by the Parliamentary Committee of the Council of the Society of Accountants and Auditors' to the Warmington Committee (1906). With reference to Clause 78 of Table A of the 1862 Act, it stated 'That it is not advisable that books of account should be open to the inspection of members, as competitors might become members to acquire information' (reprinted in Edwards, 1980, Vol. II: 64). A memorandum to the Davey Committee by solicitor Harold Brown includes the point that 'shares are sometimes acquired for the express purpose of getting information for rivals, or harassing the management' (1895, Appendix, No. 6: 75). Edwards and Webb (1985:180) also note that amendments to Table A omitting provisions for shareholder inspection of the books have been attributed to the danger of competitors purchasing shares to obtain access to information.

International competitiveness may be adversely affected for companies subject to non-uniform reporting (Edwards and Smith, 1996:158). Considering the 'most important question...of the registration of the balance sheet', the 1896 Select Committee noted the objection 'urged in several quarters, that it would enable competitors, and especially foreign competitors, to compete with success' (BPP, 1896, minutes 1493 and 1502). At that time, some members of the committee were clearly not persuaded by the argument. Nevertheless, in an era of increasing global competition, and in the absence of effective international standards universally applied, competitive disadvantage may be a persuasive argument against greater levels of disclosure.

4.7. Separation of Ownership and Control

Berle and Means (1967:112) argue that before the industrial revolution the 'owner-worker' performed three functions with respect to his enterprise: having an interest in it, having power over it and acting with respect to it. During the 19th century, however, 'the bulk of industrial production came to be carried on by enterprises in which a division had occurred, the owner fulfilling the first two functions while the latter was in large measure performed by a separate group, the hired managers'.

Child (1969:36) outlines an argument in which the second of the three functions, having power over the enterprise, is also largely assumed by managers. As enterprises become larger and more complex, they rely increasingly on the employment of specialist managers. As more share capital is issued, share-ownership becomes dispersed and the owners' control is divided. Absenteeism is encouraged and 'the consequent power vacuum is filled by an increasingly entrenched management'.

Separation of ownership and control is particularly associated with the advent of the joint stock company, although delegation of management and restricted access to information have been practical features of organisations at all times.[9] Edwards and Webb (1985:179) note that the separation gathered momentum in a number of industries, particularly manufacturing, in the latter part of the 19th century 'as companies increasingly looked to the general public to provide funds needed to help expansion'.

The separation of ownership and control creates an agency relationship between shareholders and managers, a subject on which a considerable body of literature has emerged in recent periods.[10] Contracts between shareholder principals and manager agents empower managers to act on behalf of the company, set limits on the extent of managers' authority and prescribe their accountability to shareholders. It is not, however, possible to cover all eventualities, and 'the lack of a complete contract allows the participants in an agency relationship to pursue their own interests at the expense of other participants' (Bromwich, 1992:320).

A distinguishing feature of an agency relationship is 'the freedom with which an agent may carry out his employment' (Batt, 1929:7). Ijiri (1983:80) argues that the feeling of being trusted is often essential to motivation, and that this may be seriously endangered by 'over-accountability'. As agency relationships developed, the ability of shareholders to question minute details of managers' actions would be increasingly at odds with the degree of autonomy which managers might reasonably expect. In the 1840s, for example, the accounts of the Great Western Railway Company were circulated about a week before the annual meeting to the proprietors, who were entitled by law to have access to the original documents and to compare the accounts with them. The company's chairman (Charles Russell) told the 1849 Select Committee that when the accounts came before the general meeting, 'the catechizing that results from the circulation of those accounts is by no means very agreeable to the gentleman who has the misfortune to occupy the chair upon the occasion...' (BPP, 1849, minutes 1910–1911). In a developing, competitive market for successful professional managers, companies might be expected to have acceded to contracts requiring less detailed disclosures.[11]

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[9] See, for example, references to the Free British Fishery Society (1750) and the South Sea Company (1734/5) in DuBois, 1938:130 and 339.

[10] For example, Jensen and Meckling (1976), Fama (1980), Watts and Zimmerman (1983). See Bromwich (1992, Part IV) for a review and an annotated selection of references (p. 356, note 1).

Managers involved in a company's day to day activities have superior information. Shareholders, external to the company, lack not only the immediate first-hand knowledge of operations, but also information on the opportunities available to the firm and the extent of the managers' endeavours. This asymmetry of information contributes to the shift in power from owners to managers and increases the risk that managers might abuse that power, restricting access to information to a greater extent than is consistent with the interests of shareholders and the public.

This risk has been perceived since at least the 1840s, at that time principally with reference to unlimited companies. The anonymous witness 'C. D. Esq.' told the Select Committee on Joint Stock Companies: 'I know, practically, that the directors assume to themselves a power which probably neither their deeds of settlement nor their acts give them, and that the shareholders occasionally experience very great difficulty in becoming acquainted with the nature of the concerns in which they are engaged' (BPP, 1844, minute 1286). In similar vein, giving evidence to the Select Committee on Investments for the Savings of the Middle and Working Classes, one barrister (Edward Vansittart Neale) told the committee: 'I have heard people often express a reluctance to engage in any enterprise which would make them partners unless they were members of the direction, so as to know what was going on', and another (John Malcolm Ludlow) that 'we are speaking of joint-stock companies in which the shareholders are delivered over, bound hand and foot, to the mercy of the directors' (BPP, 1850, minutes 48 and 151).

In public companies today, small private shareholders are almost completely separated from management, and their position remains weak. However, the proportion of ordinary shares held directly by private investors has 'declined inexorably' in the second half of this century and the decline has not even been slowed by the major privatisations of the 1980s, in which shares 'were actively aimed at small investors in the declared aim of widening share ownership' (Rutterford, 1993:127; 353).

Information may be released to small investors through investment analysts, stockbrokers and financial journalists who claim to have access to non-public information, although they 'cannot be relied upon to satisfy all demands for information' (Bromwich, 1992:242). It is also argued that close cooperative relationships between financial institutions and investee companies provide a 'behind the scenes' self-regulatory mechanism. Because of the possible accusation of insider trading, the financial institutions do not directly seek price-sensitive information, although they have access to other non-public information (Holland, 1996:134; 163).

The Cadbury Report (1992) acknowledges that 'the institutions are in a position to keep in touch with the boards of the companies in which they have invested, in a way that is not feasible for the individual shareholder'. It is not considered possible in this respect to 'put both classes of shareholder on the same footing', but boards must ensure that any significant statements concerning their companies are made publicly and so are equally available to all shareholders (para. 6.13).

Financial reporting databases may provide a practical vehicle for increasing information disclosure and a means of releasing that information more fairly into the public domain, reducing the risk of insider trading. However, just as the weakness of the shareholders' position in the 19th century enabled shareholders' rights to inspect company records to be curtailed with little resistance, today's shareholders are unlikely to be able to persuade managers to develop or support financial reporting databases that will improve the provision of information. The attention of regulators might therefore be directed to ensuring that any information provided to powerful interest groups should be made available at the same time to all interested parties with a right to know.

5. Summary and conclusions

Shareholders' access to information about their company, at one time largely unfettered, was gradually but severely curtailed over an extended period, mainly in the second half of the 19th century. Reasons for this can be found in changes in the ownership, management and operating environment of companies during that period. The following contributory factors are identified in this paper:

- The large numbers and wide geographical dispersion of shareholders.
- The lack of financial sophistication of many shareholders.
- The time required to examine high volumes of transactions.
- The existence of ready markets for the transfer of shares.

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[11] Evidence of this trend can be seen, for example, in Edwards and Webb (1985:183) discussed above.

- The delegation of inspection of accounting records.
- The risk that disclosures might lead to competitive disadvantage.
- The substantial separation of ownership and control.

All these factors continue to apply to listed companies today. Most have large numbers of shareholders, widely dispersed around the country and indeed the world. Many of these shareholders have little understanding of accounting, but even the more sophisticated, if given access to accounting records, would seldom consider it feasible that they themselves should carry out a comprehensive examination. Shareholders' perceived need for individual vigilance is reduced by efficient markets enabling shares to be sold quickly at current market prices, and by a protective regulatory environment including statutory audit. Competition is often global, and arguments of competitive disadvantage are persuasive. At least as far as the individual shareholder is concerned, the separation of ownership and control is now almost complete.

Although these factors continue to apply, their effects in limiting shareholders' access to information may in most cases be reduced by financial reporting databases. Current levels of disclosure may therefore be less than optimal for effective corporate governance. Large quantities of information could be made available simultaneously to large numbers of people virtually anywhere in the world. The inclusion of commentary and the use of a layered structure could cater for users with very different levels of financial sophistication. Time devoted to examination of information could vary from a few seconds for a directed enquiry to a much longer period if, for example, a user chose to download and process disaggregated data.

The efficiency of securities markets might be enhanced by faster and more equitable dissemination of information using financial reporting databases. Confidence in the system of accountability, undermined by recent criticisms of the nature and scope of the audit, might be increased in an environment of more open access to information.

However, the effects of the last two of the factors identified here as contributing to the loss of shareholder rights of inspection are unlikely to be reduced by financial reporting databases. Fuller information, made available more frequently and more quickly to shareholders, and thus released into the public domain, may lead to competitive disadvantage. The agency relationship arising from separation of ownership and control calls for a degree of managerial autonomy which must be balanced with the need for accountability. However, managers may take advantage of concerns about competitive disadvantage, and of the degree of autonomy afforded to them, to withhold information which it is in the public interest to disclose. Further research into the prospects for financial reporting databases might therefore be directed to determining optimum levels of disclosure and the means by which these may be achieved.

The current system of accountability, based primarily on audited financial statements, emerged initially as an addition to shareholders' rights of inspection. In due course, however, rights of inspection ceased to exist, and the system of accountability was weakened in a way that may not have been fully appreciated by shareholders and regulators at that time. Developments in information and communications technology now make it possible to restore some of the benefits of a more broadly-based system of accountability. However, it is unlikely that preparers will significantly increase disclosures or begin to develop financial reporting databases in the absence of an initiative by users or regulators.

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Linear Information Dynamics, Dividend Irrelevance, Corporate Valuation and the Clean Surplus Relationship

Andrew W. Stark*

Abstract—This paper adopts the linear information dynamics framework pioneered in Ohlson (1979) and Garman and Ohlson (1980) (and subsequently used in, in particular, Ohlson, 1989, 1995 and Feltham and Ohlson, 1995) for thinking about desirable properties of earnings numbers in the context of the market valuation of firms, where such valuations are fundamentally based on expected future dividends. The first purpose of this paper is to consider the valuation-relevance of clean surplus earnings when there are two distinct components of clean surplus earnings whose evolutions are governed, along with book value and dividends, by a system of linear information dynamics, and dividend irrelevancy holds. The system of linear information dynamics assumed ensures that corporate value is a linear combination of the two components of clean surplus earnings, book value and dividends. One question becomes—under what circumstances are clean surplus earnings (combined with book value and dividends) sufficient for corporate valuation without a knowledge of the breakdown of clean surplus earnings into its separate components? This paper develops the conditions defining these circumstances. At the other extreme, another question can be asked—under what circumstances is one component of clean surplus earnings irrelevant to corporate valuation? This paper identifies some conditions that identify these latter circumstances. The second purpose of the paper is to identify implications of these results for both the traditional arguments about the desirability of measuring earnings on a clean surplus basis and also the more contemporary issues surrounding FRS3. A third purpose is to discuss the implications of the overall analysis for the empirical testing of the relationship between market prices and earnings numbers, and for empirically-justified definitions of maintainable earnings.

1. Introduction

Brief and Peasnell (1996) summarise the main historical arguments for and against the use of clean surplus concepts of recognising income. One basic theme underlying these arguments is the idea of the predictive ability of the earnings number or a component of earnings. One argument suggests that income should not reflect non-recurring transactions, presumably because if the transactions are non-recurring then they have no ability to predict future valuation-relevant events over and above any impact they might have on, for example, book value.[1] A related aspect of the argument is that more variability in an income series reduces the predictive ability of the income series. If the use of clean surplus earnings increases the variability of the income series then, by implication, predictive ability would be better served by a 'dirty surplus' income series that effectively smoothed the series of clean surplus earnings. Brief and Peasnell point out that the notion of predictive ability embedded in these arguments is not well defined.

Although the previous paragraph emphasises history, there are contemporary echoes of the arguments above in the debate over the earnings disclosures recommended in FRS3, *Reporting Financial Performance* (Accounting Standards Board, 1992), which include not only a profit and loss account but also a 'Statement of Recognised Gains and Losses', the latter statement to receive the same prominence as the other financial statements. The Statement of Recognised Gains and Losses includes all recognised gains and losses that increase or decrease net assets, irrespective of their recognition, or not, as income. Damant (1993a) suggests that '... the bottom line in the p&l account, as it will be delineated by FRS3, will be a questionable number: for example, if the profits and losses on the sale not only of assets but of businesses are included, it could hardly be anything else.' The word 'questionable' appears to be interpreted here in terms of using earnings num-

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*The author is professor of accounting, Manchester Business School. This paper has benefited from the comments of John O'Hanlon, Ken Peasnell, Peter Pope, Stephen Taylor, Martin Walker, participants at the 1996 Financial Accounting and Auditing Research Conference, seminar participants at the University of Lancaster and an anonymous referee. The usual caveat applies. Correspondence should be addressed to the author at Manchester Business School, Booth Street West, Manchester M15 6PB. This paper was submitted in May 1996 and accepted in February 1997.

[1] Book value is synonymous with the terms shareholders' equity or net assets for the purpose of this paper.

bers to predict future performance. Further, in the context of the need to delineate a 'true' earnings figure from FRS3 disclosures (with the implication that the income measures recommended in FRS3 are not such figures), Damant (1993b) points out that financial analysts instinctively look to create a measure of 'maintainable' earnings via which to forecast future performance. Nonetheless, he also argues that there is no standardised methodology for the calculation of maintainable earnings. Consequently, he advocates the use of Institute of Investment Management and Research (IIMR) headline earnings, a measure of earnings that reflects a factual report of the aggregate 'trading' outcome for the year (which, by implication, partitions (clean surplus) earnings into trading and non-trading components). The aggregation, therefore, has the potential to combine the outcomes of some trading activities which are distinctly unusual with those that are 'business as usual'. Overall, at the heart of this concern with FRS3 disclosures appears to be the distinctive predictive ability, or lack thereof, of components of earnings.

This paper adopts the linear information dynamics framework pioneered in Ohlson (1979) and Garman and Ohlson (1980) (and subsequently used in, in particular, Ohlson 1989, 1995 and Feltham and Ohlson, 1995) for thinking about desirable properties of earnings numbers in the context of the market valuation of firms, where such valuations are fundamentally based on expected future dividends.[2] Such an approach has a number of advantages. First, it establishes a specific purpose of prediction—the prediction of future dividends. Second, it specifies the way in which firm characteristics potentially useful for the prediction of future dividends are linked through time with both each other and dividends—a linear Markovian structure.[3] Third, because the approach leads to an analytically tractable expression for valuing firms in terms of accounting numbers, and the role of the latter in predicting future dividends, it can lend insight into the extent to which components of earnings are individually valuation-relevant.

The assumption that potentially valuation-relevant accounting variables evolve according to linear information dynamics is then combined with an assumption that dividends are irrelevant to the valuation of the firm (as in Ohlson, 1989, 1995 and Feltham and Ohlson, 1995). Essentially, dividend irrelevancy amounts to treating dividend payments as zero net present value projects. Thus, an additional £1 of current dividend payment reduces current corporate value by £1 and next period's earnings by £(R_F-1), where R_F is one plus the risk-free rate of return.

The first purpose of this paper is to consider the valuation-relevance of clean surplus earnings when there are two distinct components of clean surplus earnings, each of whose evolutions are governed, along with book value and dividends, by a system of linear information dynamics, and dividend irrelevancy holds. Note that clean surplus earnings can always be constructed, given successive observations of book value and knowledge of dividends for the intervening period. The system of linear information dynamics assumed ensures that corporate value is a linear combination of the two components of clean surplus earnings, book value and dividends. One question becomes—under what circumstances are clean surplus earnings (combined with book value and dividends) sufficient for corporate valuation without a knowledge of the breakdown of clean surplus earnings into its separate components? This paper develops the conditions defining these circumstances.

At the other extreme, another question can be asked—under what circumstances is one component of clean surplus earnings irrelevant to corporate valuation? This paper identifies some conditions that identify these latter circumstances. The second purpose of the paper is to identify implications of these results for both the traditional arguments about the desirability of measuring earnings on a clean surplus basis and also the more contemporary issues surrounding FRS3. A third purpose is to discuss the implications of the overall analysis for the empirical testing of the relationship between market prices and earnings numbers, and for empirically-justified definitions of maintainable earnings.

The remainder of the paper is organised as follows. Section 2 presents the model underlying the analysis contained in the paper. Section 3 contains two propositions that constitute the paper's main results—the first on circumstances where the components of earnings can be safely aggregated, and the second on circumstances where those components are valuation-irrelevant. Section 4 first discusses the implications of the results in Section 3 for historical arguments concerning the desirability of reporting earnings on a clean surplus basis and also for the debate surrounding FRS3. Then it considers the implications of the study for empirical testing of the relationship between market prices and earnings numbers. The paper concludes with a brief summary of its main points.

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[2] The term dividends is used in a way such that it is synonymous with net shareholder cash flows. Net shareholder cash flows are the difference between the net assets distributed to shareholders and inflows of net assets from shareholders.

[3] Note that a Markovian structure suggests that the current vector of firm characteristics is sufficient for predicting both itself and, specifically, future dividends. The disadvantage, therefore, of using the linear Markovian structure is that it cannot examine the argument referred to in Brief and Peasnell (1996) and made by May (1937) that current earnings should be understood as the latest chapter in the history of a firm that can only be understood by reference to all the previous chapters. Such an understanding of earnings implies the importance of historical context. Because of the 'no-memory' aspect of Markovian processes, historical context is denied any importance. Antle, Demski and Ryan (1994) provide an analysis where historical context is important in evaluating a current signal from an accounting system. The response of market prices to accounting signals becomes complicated in such an environment.

2. Model

The model used is a simple extension of the basic Ohlson (1989) analysis. The linear information dynamics involve four variables, x_{1t}, x_{2t}, y_t and d_t, all assumed observable. y_t represents book value. d_t represents dividends net of owners' contributions. x_{1t} and x_{2t} are components of clean surplus earnings.

To clarify, independent of how earnings are reported in the profit and loss account, whether on a clean surplus basis or not, the change in book value plus the net of dividends paid and additional equity raised defines clean surplus earnings. The sum of x_{1t} and x_{2t} is defined to equal this amount. For example, in the UK, companies revalue fixed assets at regular intervals and credit/debit upward/downward revaluations direct to shareholders' equity. Nonetheless, the change in the revaluation reserve contained within shareholders' equity over a specified period is a component of clean surplus earnings for that period. Thus, we can envisage that x_{2t} is the change in the revaluation reserve and x_{1t} is regular ordinary earnings (on the assumption that there are no other items giving rise to a difference between net profit and clean surplus earnings). Alternatively, if ordinary earnings are already on a clean surplus basis, x_{1t} and x_{2t} can represent any partition of clean surplus earnings (such as, for example, cash flow and accruals components or earnings before extraordinary items and extraordinary items). Given the clean surplus relationship, we have:

$$y_{t+1} = y_t + x_{1t+1} + x_{2t+1} - d_{t+1} \tag{1}$$

The linear information dynamics can be described in the following way. Let z_t be a column vector containing x_{1t}, x_{2t}, y_t and d_t in its first, second, third and fourth rows, respectively. Define a 4 by 4 matrix, denoted Ω, with typical element θ_{ij}, and E, a 4 by 4 matrix of mean zero random variables, with typical element ε_{ijt}. The matrix Ω is assumed known. The ε_{ijt+1}'s are unpredictable, given information available at time t. The linear information dynamics system relating successive values of the elements of z_t is defined by:

$$z_{t+1} = (\Omega + E)z_t \tag{2}$$

Written out in full, matrix equation (2) becomes:

$$x_{1t+1} = (\theta_{11} + \varepsilon_{11t+1})x_{1t} + (\theta_{12} + \varepsilon_{12t+1})x_{2t} + (\theta_{13} + \varepsilon_{13t+1})y_t + (\theta_{14} + \varepsilon_{14t+1})d_t \tag{2a}$$

$$x_{2t+1} = (\theta_{21} + \varepsilon_{21t+1})x_{1t} + (\theta_{22} + \varepsilon_{22t+1})x_{2t} + (\theta_{23} + \varepsilon_{23t+1})y_t + (\theta_{24} + \varepsilon_{24t+1})d_t \tag{2b}$$

$$y_{t+1} = (\theta_{31} + \varepsilon_{31t+1})x_{1t} + (\theta_{32} + \varepsilon_{32t+1})x_{2t} + (\theta_{33} + \varepsilon_{33t+1})y_t + (\theta_{34} + \varepsilon_{34t+1})d_t \tag{2c}$$

$$d_{t+1} = (\theta_{41} + \varepsilon_{41t+1})x_{1t} + (\theta_{42} + \varepsilon_{42t+1})x_{2t} + (\theta_{43} + \varepsilon_{43t+1})y_t + (\theta_{44} + \varepsilon_{44t+1})d_t \tag{2d}$$

Ohlson (1989), amongst others, makes it clear that, given such a system of linear information dynamics, a linear valuation function, implicitly based on the prediction of expected future dividends using the system of equations described by (2), can be defined.

Thus, if P_t is the price at time t, there exists a row vector, $\beta = (\beta_1, \beta_2, \beta_3, \beta_4)$, such that:

$$P_t = \beta z_t \tag{3}$$

or, again written out in full,

$$P_t = \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 y_t + \beta_4 d_t \tag{3a}$$

If we assume that investors are risk-neutral, the expected return on holding a share in a firm with linear information dynamics as described above by equation (2) or, equivalently, equations (2a–2d), will be constrained by equilibrium considerations to equal the risk-free rate of return. Define R_F as one plus the risk-free rate of return. Then, we have:

$$R_F P_t = E[P_{t+1} + d_{t+1} | z_t] \tag{4}$$

Using the linear information dynamics and defining e_4 as the row vector (0, 0, 0, 1), equation (4) gives:

$$R_F(\beta z_t) = \beta \Omega z_t + e_4 \Omega z_t \tag{5}$$

which reduces to:

$$\beta = e_4 \Omega (R_F I - \Omega)^{-1} \tag{6}$$

where I is the 4 by 4 identity matrix.[4]

Equation (6) defines the linear valuation function given the underlying information dynamics for *any* Ω. The clean surplus relationship defined by equation (1), however, imposes structure on Ω. Further, the relationship imposes linear dependence within the elements of E. Using the clean surplus relationship from equation (1) and substituting from equation (2) or equations (2a–2d) gives:

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[4] Equation (5) is essentially identical to equation (1) in Ohlson (1989), other than through reasons of the increased dimensionality of z_t.

$$\begin{aligned}&x_{1t}(\theta_{31} + \theta_{41} - \theta_{11} - \theta_{21}) + x_{2t}(\theta_{32} + \theta_{42} - \theta_{12} - \theta_{22}) + \\ &y_t(\theta_{33} + \theta_{43} - \theta_{13} - \theta_{23}) + d_t(\theta_{34} + \theta_{44} - \theta_{14} - \theta_{24}) + \\ &x_{1t}(\varepsilon_{31t+1} + \varepsilon_{41t+1} - \varepsilon_{11t+1} - \varepsilon_{21t+1}) + x_{2t}(\varepsilon_{32t+1} + \\ &\varepsilon_{42t+1} - \varepsilon_{12t+1} - \varepsilon_{22t+1}) + y_t(\varepsilon_{33t+1} + \varepsilon_{43t+1} - \\ &\varepsilon_{13t+1} - \varepsilon_{23t+1}) + d_t(\varepsilon_{34t+1} + \varepsilon_{44t+1} - \varepsilon_{14t+1} - \varepsilon_{24t+1}) \\ &= y_t \qquad (7)\end{aligned}$$

Because equation (7) is a functional relationship, the folloing constraints on Ω are implied:

$$\theta_{31} + \theta_{41} = \theta_{11} + \theta_{21} \qquad (8)$$

$$\theta_{32} + \theta_{42} = \theta_{12} + \theta_{22} \qquad (9)$$

$$\theta_{33} + \theta_{43} = 1 + \theta_{13} + \theta_{23} \qquad (10)$$

$$\theta_{34} + \theta_{44} = \theta_{14} + \theta_{24} \qquad (11)$$

The following constraint arises on E:

$$\varepsilon_{3jt+1} + \varepsilon_{4jt+1} = \varepsilon_{1jt+1} + \varepsilon_{2jt+1}, \ \forall_j \qquad (12)$$

Thus, the random elements in the linear information dynamics cannot all be independent—not surprisingly since, because of the clean surplus equation, the sum of left hand sides of equations (2a) and (2b) is equal to the sum of the left hand sides of equations (2c) and (2d) less opening book value.

Further structure on allowable Ω's is imposed by invoking two additional conditions. First, if dividends are irrelevant to corporate valuation (as in Modigliani and Miller, 1958), it is necessary that:

$$\partial P_t / \partial d_t = -1 \qquad (13)$$

Assuming that one additional £1 of dividend reduces book value by £1, applying equation (13) to equation (3) or (3a) suggests that:

$$\beta_4 - \beta_3 = -1; \text{ or}$$

$$\beta_4 = \beta_3 - 1 \qquad (14)$$

Because β is a function of Ω, equation (14) acts as an additional constraint on allowable values of elements of Ω.

Applying one further restriction from Miller and Modigliani (1961) suggests that:

$$-\theta_{13} + \theta_{14} - \theta_{23} + \theta_{24} = -(R_F - 1) \qquad (15)$$

This condition states that an increase of £1 in dividends will reduce next period's current surplus earnings ($x_{1t+1} + x_{2t+1}$) by an amount of £($R_F - 1$). The effect of changing d_t has two aspects. First, increasing dividends will have an expected effect of ($\theta_{14} + \theta_{24}$) via the dividend terms in the linear information dynamics equations for x_{1t+1} and x_{2t+1}. Second, increasing current dividends causes a one-for-one reduction in y_t. Thus, increasing dividends has a further effect of $-(\theta_{13} + \theta_{23})$ via the relevant book value terms in the linear information dynamics equations.

Gathering together the various elements of the model, the essential purpose of subsequent analysis is to analyse the characteristics of β subject to various essential constraints. These constraints are expressed in equations (8), (9), (10), (11), (14) and (15). The analysis will proceed by imposing yet more constraints to capture the essence of the valuation-relevance of clean surplus earnings.

3. Analysis

In this section, we investigate two ideas. First, we look for circumstances where valuation can proceed on the basis of knowing only clean surplus earnings. Separate knowledge of x_{1t} and x_{2t} is unnecessary for the purposes of corporate valuation. Second, we look for circumstances where one of the components of clean surplus earnings is valuation irrelevant.

3.1. The Sum of x_{1t} and x_{2t} is All That is Important for Valuation

The initial argument adopted is to consider circumstances where the two elements of clean surplus income, x_{1t} and x_{2t}, have the same valuation-relevance. What is meant by this is that each element has the same multiplier in the linear valuation equation described by equation (3). This implies that:

$$\beta_1 = \beta_2 \qquad (16)$$

If equation (16) holds, then there is no advantage in disclosing x_{1t} and x_{2t} separately, as clean surplus earnings is the only valuation-relevant definition of earnings. Under such circumstances there is a relatively clear case for arguing that earnings should be calculated on a clean surplus basis. Circumstances under which x_{1t} and x_{2t} are only valuation-relevant with respect to their sum are identified in Proposition 1 below:

> **Proposition 1:** Given the clean surplus constraints given by equations (8), (9), (10) and (11), and the constraints on the impact of dividends on future earnings and current price given by equations (14) and (15), x_{1t} and x_{2t} are valuation-relevant only with respect to their sum if, and only if, $\theta_{11} + \theta_{21} = \theta_{12} + \theta_{22} = \theta_{31} + \theta_{41} = \theta_{32} + \theta_{42}$.

Proof: See Appendix.

From Proposition 1, the following Lemma can be derived.

Lemma 1: If $\beta_1 = \beta_2$, and letting $\omega = \theta_{11} + \theta_{21}$, the system of linear information dynamics can be reduced to:

$$\begin{aligned}(x_{1t+1} + x_{2t+1}) = {} & (\omega + \varepsilon_{11t+1} + \varepsilon_{12t+1} + \varepsilon_{21t+1} + \\ & \varepsilon_{22t+1})(x_{1t} + x_{2t}) + \\ & [(R_F - \omega)(R_F - 1)/R_F + \\ & \varepsilon_{13t-1} + \varepsilon_{23t+1}]y_t - \\ & [\omega(R_F - 1)/R_F + \\ & \varepsilon_{14t+1} + \varepsilon_{24t+1}]d_t \end{aligned} \tag{17}$$

$$\begin{aligned}(y_{t+1} + d_{t+1}) = {} & (\omega + \varepsilon_{11t+1} + \varepsilon_{12t+1} + \\ & \varepsilon_{21t+1} + \varepsilon_{22t+1})(x_{1t} + x_{2t}) + \\ & [1 + (R_F - \omega)(R_F - 1)/R_F + \\ & \varepsilon_{13t+1} + \varepsilon_{23t+1}]y_t - \\ & [\omega(R_F - 1)/R_F + \\ & \varepsilon_{14t+1} + \varepsilon_{24t+1}]d_t \end{aligned} \tag{18}$$

and

$$\begin{aligned}d_{t+1} = {} & (\theta_{41} + \varepsilon_{41t+1})x_{1t} + (\theta_{42} + \varepsilon_{42t+1})x_{2t} + \\ & (\theta_{43} + \varepsilon_{43t+1})y_t + (\theta_{44} + \varepsilon_{44t+1})d_t \end{aligned} \tag{19}$$

In the light of Lemma 1, Proposition 1 can now be interpreted as follows. First, note that equations (17) and (18) are entirely equivalent—equation (17) is equation (18) with y_t subtracted from both sides. Second, observe that for the prediction of clean surplus earnings or, equivalently, the cum dividend book value, it is only the sum of x_{1t} and x_{2t} that matters. x_{1t} and x_{2t} have no separate predictive role.[5] It is only in the prediction of future dividends that x_{1t} and x_{2t} can have separate predictive roles. But, because of dividend irrelevancy, this last phenomenon is of no importance from a valuation perspective. Thus, overall, it is only the sum of x_{1t} and x_{2t} that matters from a valuation perspective, and the breakdown of clean surplus earnings into its individual components has no information content.

Note, however, that this does not tightly restrict the stochastic processes governing x_{1t} and x_{2t}. The two components of clean surplus earnings can have quite distinct stochastic generating processes consistent with their sum being sufficient, in conjunction with book value and dividends, for the forecasting of future clean surplus earnings.[6] For example, a situation in which x_{1t} is of no use in predicting x_{2t+1} and x_{2t} is of no use in predicting x_{1t+1} is entirely consistent with the possibility that the two components of clean surplus earnings have no separate predictive roles in the prediction of future clean surplus earnings. Alternatively, suppose $\theta_{11} = .6$, $\theta_{12} = .4$, $\theta_{21} = .1$ and $\theta_{22} = .3$. Here x_{1t} carries greater weight, *ceteris paribus*, in predicting itself than x_{2t}, whereas the opposite holds true for x_{2t}. Further, and again *ceteris paribus*, x_{1t} and x_{2t} appear less important jointly in predicting x_{2t} than x_{1t}. Nonetheless, neither component of earnings is separately valuation-relevant. The aggregation (or disaggregation) of earnings components is a more subtle issue than comparing the stochastic processes via which they are generated or, indeed, the economic processes underpinning the stochastic processes.[7]

3.2. *One of x_{1t} and x_{2t} is Irrelevant for Valuation Purposes*

The way in which the analysis in this sub-section proceeds is to designate, without loss of generality, x_{2t} as valuation-irrelevant. This implies that $\beta_2 = 0$. We then look for sufficient conditions on elements of Ω that allow the valuation-irrelevancy of this component of clean surplus earnings. One such sufficient set of conditions is given in Proposition 2.

> **Proposition 2:** Given the clean surplus constraints given by equations (8), (9), (10) and (11), and the constraints on the impact of dividends on future earnings and current price given by equations (14) and (15), $\theta_{12} = \theta_{22} = \theta_{32} = \theta_{42} = 0 \Rightarrow \beta_2 = 0$.

Proof: See Appendix.

The implication of Proposition 2 is as follows. Setting $\theta_{i2} = 0$, $\forall$ i, means that x_{2t} is of no help in predicting x_{1t+1}, x_{2t+1}, y_{t+1} and d_{t+1}. The implication of this result is that clean surplus earnings are *not* valuation-relevant. Only one component of it is —x_{1t}. x_{2t} has no predictive power in itself over and above its impact on y_t and, hence, is not valuation-relevant.[8,9]

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[5] Another way of looking at this issue is to remember the result that market value is identically equal to book value plus the present value of future residual incomes (see, for example, Edwards and Bell, 1961; Kay, 1976; Ohlson, 1989; Peasnell, 1981; 1982; Preinreich, 1936; and Stark, 1986). This valuation relationship is entirely equivalent to portraying market value as the present value of future dividends if dividend irrelevancy holds. Within this relationship, book value can be measured according to any set of accounting principles. Crucially, however, residual income must be based upon an earnings figure calculated on a clean surplus basis. As a consequence, the prediction of future clean surplus earnings has a central role in this approach to corporate valuation—even if current earnings need not be measured on a clean surplus basis.

[6] By distinct stochastic processes is meant, in particular, that equations (2a) and (2b) do not possess identical θ_{ij} coefficients. If, for example, $\theta_{11} = \theta_{22}$ and $\theta_{12} = \theta_{13} = \theta_{14} = \theta_{21} = \theta_{23} = \theta_{24} = 0$ (with the corresponding stochastic terms set to zero, too) both x_1 and x_2 would follow essentially identical univariate time series processes but, in the multivariate context of this paper, they would be described as being generated by different stochastic processes.

[7] Aggregation and disaggregation issues are endemic to accounting. Segmental and geographical area reporting are examples of disaggregations of earnings that are thought to be useful—presumably because these earnings components are thought to be potentially separately valuation-relevant.

4. Discussion

In Section 3.1 it is demonstrated that earnings measured on a clean surplus basis are valuation-relevant when each separate component of clean surplus earnings has no predictive value for clean surplus earnings or, equivalently, cum dividend book value over and above knowing the sum of the components. Under such circumstances, it might well be argued that there is some special economic significance to be attached to the clean surplus concept of earnings. But when the separate components have additional predictive ability over the sum of the components, knowledge of the individual clean surplus earnings components is important. Any reporting system that enables the separate identification of the components will suffice from an informational point of view. There is no compelling reason to report them in a clean surplus earnings statement, although such a statement might well achieve the desired informational end.

With respect to the debate surrounding FRS3, the results above suggest that if disclosures under it (for example, via the Statement of Recognised Gains and Losses) provide the desired disclosure of earnings components when all possess individual predictive value, the issue of whether the FRS3 bottom line is a questionable number does not appear important. On the separate identification and aggregation of trading activities into headline earnings (as recommended in Damant, 1993b, in response to FRS3), two points can be made. First, it is a sensible move to segregate the earnings outcomes of trading from non-trading activities if they are separately valuation-relevant. Second, the aggregation of all trading activities into one aggregate statistic might make less sense if the individual components of trading income are individually valuation-relevant. Damant (1993b) suggests that the IIMR decided that their concept of headline earnings '... should be a factual one, reflecting all the trading items reported for the year. Unusual items are included, however unusual and however large, if they concern trading (although if they are large they should be mentioned in a note to the earnings, like the old 'exceptional' earnings category)'. Given this insight, it seems entirely possible that headline earnings aggregate components of earnings that are individually valuation-relevant. Further, whether the size of an unusual item should determine separate identification within the concept of headline earnings is a moot point in the light of the results above. It is the stochastic properties of these 'unusual' items that matters, not just their current size.[10]

In Section 3.2, going to the extreme when x_{2t} is valuation-irrelevant, clean surplus earnings are not important in any fundamental economic sense. It might well be argued as a consequence that it is not unreasonable if, in accounting terms, x_{2t} is sent straight to shareholders' equity without passing through the income statement.[11,12]

Further, consideration of this case provides some insight into income-smoothing in a linear information dynamics setting and also the notion of 'maintainable' earnings. This insight can best be developed by initially adding in a few more restrictions on Ω. Suppose that $\theta_{21} = \theta_{23} = \theta_{24} = 0$, in addition to the restrictions on Ω used to generate the valuation irrelevancy of x_{2t}. Given these restrictions, x_{2t} is purely random with mean zero. Further, assume that the stochastic elements of x_{2t} are independent of those of x_{1t}. Thus, x_{1t} can be interpreted as capturing the expected value of clean surplus earnings at time t by eliminating a random element contained within clean surplus earnings. Hence, x_{1t} provides a less volatile and, therefore, smoothed version of clean surplus earnings.

Developing this insight suggests that when we look at x_{1t} from this perspective we can interpret it generally as a subtly smoothed version of clean surplus income, even without the additional restrictions on Ω suggested in the paragraph above. The smoothing mechanism takes into account the stochastic process generating the valuation-irrelevant element of clean surplus earnings, x_{2t}.

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[8] Note that to point out that a component of clean surplus earnings is valuation-irrelevant is not a unique observation. In Ohlson (1989), clean surplus earnings themselves are valuation-irrelevant when they are purely transitory. The results above expand on this result in the sense that whereas Ohlson's (1989) results suggest that clean surplus earnings are either valuation-relevant or they are not, the results here allow for an intermediate stage where a dirty surplus definition of earnings is valuation-relevant.

[9] Ohlson (1989, Sec.IX) allows the risk neutrality condition to be dropped in an analysis using the same type of linear information dynamics framework as employed here. The effect of risk aversion is merely to create what essentially is a 'certainty-equivalent' version of Ω, which we can refer to as Ω^*, which can be substituted for Ω in the analysis in this section. Thus, any statements in this or subsequent sections about the predictive value of variables, or aggregations of variables, by reference to conditions on Ω can be replaced with equivalent statements with respect to Ω^*, although the concept of 'risk-adjusted' predictive value is clearly less intuitive and less easy to test empirically.

[10] In fairness, it must be pointed out that Damant (1993a, 1993b) recognises that no concept of income or earnings, including headline earnings, is going to be perfect, for the purposes of financial analysis, for all firms.

[11] Naturally, the linear valuation equation can be manipulated to suggest a valuation role for clean surplus earnings when the earnings components have separate predictive ability—but one of the earnings components will also have a separate valuation role. It is the components, and not their sum, that are of fundamental economic relevance.

Thus, the intuition advanced in historical arguments (see, for example, Arthur Andersen, 1962) of the desirability of removing elements from earnings series that have no predictive ability to create a dirty surplus earnings measure enhances the overall utility of the earnings series, can be seen to possess some substance.[13] But the issue is more subtle than whether the valuation-irrelevant component of earnings is random noise (or a non-recurring item), however. The fact that a component of clean surplus earnings is of no use in predicting other valuation-relevant data, and itself, does not imply that it is itself unpredictable. Therefore, clean surplus earnings can contain a distinctly non-random element that, nonetheless, needs to be removed in creating a dirty surplus earnings measure that is valuation-relevant. Non-recurring items might well have no individual predictive power over and above their impact on book value—but they will not necessarily constitute the complete set of earnings components with no predictive power.

Note also that thinking about dirty surplus earnings provides a basis for investigating the idea of maintainable earnings. One definition of the latter is as an earnings measure that can be used as the basis for optimal forecasting of future outcomes for valuation-relevant (accounting) variables. This seems to be consistent with the rather intuitive descriptions offered in Damant (1993a, 1993b). Maintainable earnings, therefore, are arrived at after removing from clean surplus earnings those components that have no predictive power either for their own future values or for future values of the valuation-relevant variables in the system.

Given the above, it is not surprising that, as Damant (1993b) points out, there is no consensus on the calculation of a measure of maintainable earnings. For example, in a world where firms' accounting numbers are generated by systems of linear information dynamics as described above, if, nonetheless, the coefficients of the systems vary across firms, it is entirely possible that an appropriate definition of maintainable earnings could differ across firms. Furthermore, in the absence of direct or indirect knowledge of the specifics of such systems, it is difficult to see how appropriate judgments about maintainable earnings could be made.

From the point of view of empirical testing of the relationship between stock market returns and earnings, the analytical framework of linear information dynamics and dividend irrelevance does little to restrict the search for suitable specifications. If components of clean surplus earnings have separate predictive ability, the framework suggests that a specification of the relationship between returns and earnings will involve modelling returns as a function of the level and change in each component of earnings (as in, for example, Strong and Walker, 1993).

Note that even if a component of earnings has no valuation-relevance, it will be a variable that 'explains' returns. Suppose that:

$$P_t = \beta_1 x_{1t} + \beta_3 y_t + (\beta_3 - 1)d_t \qquad (20)$$

In other words, only one earnings component has valuation-relevance. Then:

$$\begin{aligned} R_t &= P_t + d_t - P_{t-1} \\ &= \beta_1(x_{1t} - x_{1t-1}) + \beta_3 x_{1t} + \\ &\quad \beta_3 x_{2t} + (\beta_3 - 1)d_{t-1} \end{aligned} \qquad (21)$$

x_{2t} is an 'explanatory variable' of R_t because it is a part of the elimination of the $(y_t - y_{t-1})$ that occurs when the pricing equation is inserted into the definition of returns. Thus, within a returns specification that regresses returns on 'levels' and 'changes in' various components of (clean surplus) earnings, to observe a positive coefficient on a 'levels' earnings component variable is no guarantee of the valuation relevance of the earnings component. It is only if the coefficient of the 'changes in' earnings component variable is significantly different from zero that the earnings component can be said to be valuation-relevant. Nonetheless, within a framework of linear information dynamics, a significant and positive coefficient for each 'levels' earnings component variable ought to be observed, irrespective of the valuation-relevance of that component.

It is important to stress, however, that this observation crucially relies on the assumption that the linear information dynamics system is stable over time. This then implies that the valuation vector, β, is itself stable, a stability crucial to the transformation of equation (20) into equation (21). If the stochastic process governing the evolution of the vector z_t over time is assumed to possess, for example, some sort of dynamic or context-driven element, then one might conjecture that the relation between z_t and market value might not be stable over time. But, of course, one might also conjecture that the presence of dynamic or context-driven elements in the stochastic process governing the evolution of z_t could render the relation

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[12] If x_{2t} is sent straight to shareholders' equity, it will be the case that the firm lifetime-to-date sum of the x_{1t}'s will not generally equal the total excess of net assets over net equity subscribed (i.e. the sum of total equity subscriptions less the sum of dividends to date)—one argument traditionally advanced in favour of the use of clean surplus earnings (see, for example, Littleton, 1940). But, from the point of view of corporate valuation, it is not important that earnings have this property.

[13] Ohlson (1994) suggests dirty surplus earnings can be desirable when they are equal to clean surplus earnings and a mean zero random term. The argument above expands on this line of thinking somewhat because the conditions of Proposition 2 do not guarantee that $E[x_{2t+\tau}|z_t] = 0$.

between (components of) earnings and returns as described in equation (21) invalid anyway.[14,15]

The framework does not guide the researcher to what specific partitions to look for in the absence of empirical evidence on systems of linear information dynamics. Naturally, other forms of theorising might be brought to bear to justify particular partitions (for example, partitioning earnings into cash and accruals flow components or recurring and non-recurring items) which might be based on intuitive ideas of predictive ability. Essentially, however, no partition is specifically excluded as a matter of principle within the framework. The partition need not even be of clean surplus earnings because, as seen above, a component of clean surplus can be valuation-irrelevant within the framework. As a consequence, components of clean surplus earnings potentially have no relevance in an empirical setting. Thus, the framework does not provide any particular reason to focus on any particular definition of earnings and its constituent parts. Ultimately, which partitions 'work' in explaining returns is purely an empirical issue.

The type of relationships between earnings components and returns described by equation (21) have some potential for adding empirical content to the concept of maintainable earnings. Given a comprehensive set of earnings components (as provided in, for example, FRS3's Statement of Recognised Gains and Losses), and ignoring possible multicollinearity problems, components of earnings can be excluded from a dirty surplus measure of earnings if the coefficients of the annual changes in those components cannot be distinguished from zero. The coefficients of the annual changes in the remaining earnings components can be examined for equality. If the coefficients are equal, a definition of maintainable earnings equal to the sum of the latter components has empirical substance. If the coefficients are not equal, it is not clear that a single summary measure of earnings such as maintainable earnings makes sense from the point of view of optimally forecasting the future outcomes for valuation-relevant variables.

5. Conclusion

This paper examines whether a framework of linear information dynamics and dividend irrelevancy are enough to guarantee a fundamental valuation role for clean surplus earnings, when clean surplus earnings have two separately observable components and value is defined as the present value of future dividends. Within such a framework, value can be represented as a linear function of the two components of clean surplus earnings, book value and dividends. Clean surplus earnings has a fundamental role in corporate valuation if the valuation coefficients attached to the two components of clean surplus earnings are equal. In such circumstances, knowledge of the sum of the two components is sufficient for valuation purposes—knowledge of the two components separately is unnecessary.

The analysis above suggests that, at the one extreme, if clean surplus earnings, combined with book value and dividends, is sufficient for forecasting future clean surplus earnings and cum dividend book value, clean surplus earnings has a fundamental valuation role. Under these circumstances, naturally, it is reasonable to suggest that components of earnings be aggregated into a single whole within a financial reporting system. At the other extreme, one of the earnings components will be irrelevant for valuation purposes if it is of no separate help in predicting future values of both components of earnings, book value and dividends (for example, because it is non-recurring). Here, it is not unreasonable to call earnings the component of clean surplus earnings that is valuation-relevant and debit or credit the valuation-irrelevant component of clean surplus earnings straight to shareholders' equity within the financial reporting system. The reporting of dirty surplus earnings is sufficient for valuation purposes.

It seems unlikely to be the case that clean surplus earnings automatically has a fundamental role in corporate valuation. If it doesn't, and both components of earnings have separate predictive value, the issue of importance is one of disclosure—both components need to be separately disclosed. The form of their disclosure is not the key issue, although if the components are comprehensively listed in a statement whose bottom line is clean surplus earnings (in a fashion not entirely dissimilar to that recommended by FRS3), this should suffice. Further, financial analysts' concepts such as 'maintainable' earnings, which attempt to strip out of clean surplus earnings those elements that have no part to play in either predicting future outcomes of themselves or other valuation-relevant variables, or headline earnings that focus on the earnings outcome from 'trading' activities, can be seen to make some sense, although not unequivocally.

Nonetheless, underlying the whole issue of the separate and joint predictive value of earnings components are the (joint) stochastic processes governing their evolution and that of other valu-

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[14] By implication, if the coefficients of the levels of earnings components are not significantly different from zero and, further, not all equal in an empirical test, this is unequivocal evidence of model misspecification of one sort or another. Naturally, one distinct possibility when this occurs is that the empirical evidence is rejecting the underlying framework of linear information dynamics. Other model misspecification possibilities are available, however, such as omitted variables or multicollinearity.

[15] Some of the observations here echo those found in Ohlson (1989, Sec.X).

ation relevant variables. Of these processes, relatively little is known, either directly or indirectly, and until this situation is rectified, little ultimate progress can be made on answering questions concerning earnings aggregation and disaggregation.

Appendix

Proof of Proposition 1:

Only if:

Assume x_{1t} and x_{2t} are valuation-relevant only with respect to their sum. Then let $\beta' = \beta_1 = \beta_2$ and $\beta'' = \beta_3 = \beta_4 + 1$. Equations (5) or (6) reduce to the following simultaneous equations.

$$0=\beta'(\theta_{11} + \theta_{21} - R_F) + \beta''(\theta_{31} + \theta_{41}) \qquad (A1)$$

$$0=\beta'(\theta_{12} + \theta_{22} - R_F) + \beta''(\theta_{32} + \theta_{42}) \qquad (A2)$$

$$0=\beta'(\theta_{13} + \theta_{23}) + \beta''(\theta_{33} + \theta_{43} - R_F) \qquad (A3)$$

$$R_F=\beta'(\theta_{14} + \theta_{24}) + \beta''(\theta_{34} + \theta_{44} - R_F) \qquad (A4)$$

From equations (A1) and (A2), it immediately follows that:

$$\theta_{11} + \theta_{21} = \theta_{12} + \theta_{22} \qquad (A5)$$

and

$$\theta_{31} + \theta_{41} = \theta_{32} + \theta_{42} \qquad (A6)$$

The clean surplus equations (8) and (9) combined with equations (A5) and (A6) then suggest that:

$$\theta_{11} + \theta_{21} = \theta_{12} + \theta_{22} = \theta_{31} + \theta_{41} = \theta_{32} + \theta_{42}$$

◆

If:

Assume $\theta_{11} + \theta_{21} = \theta_{12} + \theta_{22} = \theta_{31} + \theta_{41} = \theta_{32} + \theta_{42}$. Equations (5) or (6) imply the following two equations involving β_1 and β_2:

$$0=\beta_1(\theta_{11} - R_F) + \beta_2\theta_{21} + \beta''(\theta_{31} + \theta_{41}) \qquad (A7)$$

$$0=\beta_1\theta_{12} + \beta_2(\theta_{22} - R_F) + \beta''(\theta_{32} + \theta_{42}) \qquad (A8)$$

Subtract equation (A8) from equation (A7). Bearing in mind that $\theta_{31} + \theta_{41} = \theta_{32} + \theta_{42}$ and $\theta_{11} - \theta_{12} = \theta_{22} - \theta_{21}$ by assumption, this subtraction provides:

$$\beta_1 = \beta_2$$

◆

Proof of Lemma 1:

If $\beta_1 = \beta_2$, Proposition 1 holds. Equating the two separate expressions for β'/β'' derivable from equations (A1) and (A3), in combination with equation (10), implies:

$$\theta_{33} + \theta_{43} = 1 + \theta_{13} + \theta_{23} = (R_F - \omega)(R_F - 1)/R_F \quad (A9)$$

Using equations (A9), (11) and (15) gives:

$$\theta_{34} + \theta_{44} = \theta_{14} + \theta_{24} = -\omega(R_F - 1)/R_F \qquad (A10)$$

Inserting equations (A9) and (A10) into the linear information dynamics gives the required result. ◆

Proof of Proposition 2:

Defining e_2 as (0, 1, 0, 0), equation (6) suggests that:[16]

$$\beta_2 = e_4\Omega(R_F I - \Omega)^{-1}e_2^T \qquad (A11)$$

Denote the elements of $(R_F I - \Omega)^{-1}$ by ϕ_{ij}. Then we can observe that, first, $e_4\Omega = (\theta_{41}, \theta_{42}, \theta_{43}, \theta_{44})$ and, second, $(R_F I - \Omega)^{-1}e_2^T = (\phi_{12}, \phi_{22}, \phi_{32}\ \phi_{42})^T$. Thus,

$$\beta_2 = \theta_{41}\phi_{12} + \theta_{42}\phi_{22} + \theta_{43}\phi_{32} + \theta_{44}\phi_{42} \qquad (A12)$$

Note that it is not possible that $\phi_{i2} = 0$, for all i. If that were so, $(R_F I - \Omega)$ would not be invertible.

Set $\theta_{i2} = 0$, for all i. These values are allowable under the clean surplus relationship. Given these values for θ_{i2}, $(R_F I - \Omega)$ has a second column filled with zeros other than in the second row, where the value is R_F. Given these values, the adjunct matrix of $(R_F I - \Omega)$ will have zeros in the same places in the second column as $(R_F I - \Omega)$. Thus, ϕ_{12}, ϕ_{32} and ϕ_{42} will be zero, by the definition of the inverse of a matrix (Coulson, 1965). Given that θ_{42} is set to zero in this scenario, $\beta_2 = 0$ from equation (A12). ◆

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[16] The superscript ^{T} denotes the transpose of the vector or matrix to which it is attached.

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The ASB's Exposure Draft Statement of Principles: A Comment

Simon Archer*

Abstract—This paper is based on a shorter comment sent to the Accounting Standards Board in response to the request for comments on the exposure draft, *Statement of Principles for Financial Reporting*. It is intended to be a comprehensive dissent from that ED, and also to suggest an alternative course of action for the ASB. In the first place, the ASB's position, according to which the provision of more fair value accounting (FVA)-based information is a central plank among its principles, is contested on the grounds of both (a) market incompleteness (entailing limited availability of reliable FVA-based information) and (b) lack of evidence of demand on the part of financial statement users for FVA-based information. In the second place, the ASB's approach to issues of recognition is subjected to critical analysis and found to be inadequate. Finally, the ASB's decision that the essential function of its *Statement of Principles* should be to advocate a set of recognition rules and measurement bases (including some that are controversial) is contested. Instead, it is proposed that the *Statement of Principles* should incorporate a larger framework, including a set of *procedural principles*, according to which the Board would reach conclusions on the various issues with which it has to deal, so that its conclusions would be seen to be authoritative because they had been reached by a process of rigorous enquiry in accordance with appropriate procedures. These principles would incorporate Rawls' (1971) notions of reflective equilibrium and procedural justice.

1. Introduction

The exposure draft, *Statement of Principles for Financial Reporting*, is the first document to set out comprehensively the Accounting Standards Board's proposals for what is, in effect, a UK conceptual framework for financial accounting and reporting (ASB, 1995). The ideas in it have already been given exposure in the form of individual draft chapters, but, as the ASB acknowledges in the second paragraph of the Preface to the ED, such piecemeal exposure does not facilitate the making of comments. For this reason, and in view of the magnitude of the changes in the basis of financial reporting that are proposed, I believe that it would have been more appropriate for the Board to have published a comprehensive discussion paper at this stage, rather than an exposure draft.

In the case of goodwill and other intangibles, both a discussion paper and a working paper preceded the exposure draft (which is yet to be issued). It is surprising that at least a similar degree of caution has not been displayed in the case of the Statement of Principles project. In the US, as Johnson, Reither and Swieringa (1995:133) have pointed out, the Financial Accounting Standards Board has concluded that such a project 'is not practical at this time'. Having studied the exposure draft and read some other comments on it, I suspect that the FASB is correct in this judgment.

The remainder of the paper is divided into three main sections. Section 2 argues that there are good reasons for doubting the cost-effectiveness of fair value accounting as advocated by the ASB; and that the issue of the role of fair values in financial reporting requires separate, empirically-based enquiry. Section 3 addresses the issues of recognition of financial statement elements, including: the interrelationship between the balance sheet and the income statement; the problematic nature of the ASB's treatment of recognition; and the issues raised by the ASB's proposed statement of total recognised gains and losses (STRGL) and the interrelationship between it and the profit and loss account.

Finally, Section 4 raises more fundamental questions regarding the possible nature and role of a conceptual framework (CF) for financial accounting and reporting. The ASB's Statement of Aims includes 'developing principles to guide it in establishing standards and to provide a framework within which others can exercise judgment in resolving accounting issues' (ASB, 1995:128). But such an aim is far from entailing the development of the type of CF presented in the ED, *Statement of Principles*, which attempts to provide answers to issues of normative accounting theory (NAT) in the aprioristic fashion of the decades prior to the 'empirical turn' in accounting research which began in the late 1960s. Instead, a different type of CF is proposed, namely one which, while lending itself to what Gaa (1988, chs. 7 and 8) terms a 'codificational' approach to standard-setting, pays explicit heed to the 'side-effects' or economic consequences of accounting rules (Gaa, 1988:144), and provides a framework within which standard-setting follows a process of 'reflective equilibrium' (Gaa, 1988:127–8; Power, 1993:49–57; Archer, 1993:102–111).

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*The author is at the University of Surrey. He wishes to thank Michael Mumford for helpful comments on earlier drafts of this paper. The usual caveats apply. Correspondence should be addressed to Professor Archer, Department of Management Studies for Tourism and Hotel Industries, University of Surrey, Guildford, Surrey GU2 5XH. This paper was submitted in May 1996 and accepted in January 1997.

2. On the cost-effectiveness of fair value accounting

The ASB has chosen to incorporate a predilection for FVA into the substance of its ED, *Statement of Principles*. This predilection appears to be based on general theoretical considerations of 'relevance to the current state of the business' (para. 5.19), rather than more specific evidence that users would benefit from, and are seeking, a substantial increase in the amount of FVA-based information in financial statements. For example, in paras. 6.46–6.49, the ED refers to 'financial adaptability' as an important attribute of an enterprise about which the financial statements in general, and the balance sheet in particular, may provide information. However, as Chambers (1966) pointed out, it is exit values which provide information most relevant to adaptability; it is not obvious that current value information other than exit values has any particular relevance for that purpose.

Is the ASB wise, then, to try to move UK financial accounting substantially towards a fair-value basis? As Mattessich (1995:52) observes:

> 'Th[e] *cost-benefit* criterion, as applied not *in* but *to* accounting, is crucial for a deeper understanding of traditional accounting valuation. I very much sympathise with [Robert R.] Sterling's dissatisfaction of [sic] the acquisition cost method from a scientific point of view; but in an applied discipline such as accounting, it is ultimately the user, or the users' consensus, that decides which method is considered to be cost-effective.'

We may note that the historical cost model is an extension of the double entry financial transaction record-keeping model from which modern accounting developed. Various writers on accounting theory, including Ijiri (1975) and Littleton (in various works), have explained the logic behind this development, the implications of which cast doubt on the wisdom of pursuing a path towards fair value accounting. With regard to the development of modern accounting, Littleton (1933:152–3) pointed out:

> 'The source of the facts on [financial] statements may be either an independent 'inventory' or a *re-arrangement of double-entry bookkeeping data*. The modern development has been in the direction of the latter...' (emphasis added).

The 're-arrangement of bookkeeping data' centred around the notions of costs 'attaching' to product, and of being 'matched' against revenues derived from the sale of product, during an accounting period. These notions were more than mere rules of thumb; they were consistent with the thinking of the classical economists, e.g. the views of assets as stored-up services and of profit arising only 'if goods changed masters' (Littleton, 1933:152).[1]

On the one hand, from the viewpoint of accounting thinkers trained in neo-classical (as opposed to classical) economics, the failure of historical cost accounting to incorporate fair values is an aspect of that model's general theoretical inadequacy (see, for example, Boulding, 1962). According to this view, the 're-arrangement of bookkeeping data' should be replaced by a more coherent set of rules offering congruence with the economists' view of value.

On the other hand, the major result of the 'evolution from bookkeeping to accounting' described by Littleton was that asset values, instead of being inputs to the accounting data-set necessary if financial statements were to be produced, were now expected to be outputs from it (as a result of the 're-arrangement of double-entry bookkeeping data' using subsidiary ledgers such as stock and fixed asset records). A move towards FVA may therefore be seen either as a move towards a 'post-modern' accounting model, or as a move back towards a pre-modern accounting model dependent on values being input regularly for financial reporting purposes. The dangers of such a move become more apparent when one considers the implications of agency theory and transactions cost economics, together with the evidence of empirical studies of the implementation of current cost accounting.

The evidence gathered from research into the trial period of SSAP 16 (Archer and Steele, 1984), and also more recent work in Australia by Jones and Love (1995), illustrate the empirical problems of implementation, and will be discussed further below. The theoretical as well as practical significance of these implementation problems are well captured by Ijiri's (1975) concepts of 'hardness' and 'measurement slack' (see also Archer, 1996:59–60). Ijiri (1975:35–40) used the term 'hardness' to refer to a characteristic of a measure, as follows: the smaller the 'measurement slack' (the extent to which the measure can be manipulated up or down), the greater the measure's 'hardness'. As he noted:

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[1] Littleton was well known for his predilection for defending historical cost accounting, but he was a major scholar and cannot be dismissed as a mere eccentric. He had experienced the economic vicissitudes of the 1920s and 1930s and the problems that changing price levels had posed for accounting and financial reporting.

> 'To a great extent, corporate accountants engage in [a] process to present the best financial appearance of the corporation under a given set of rules. It is obvious, however, that too much discretion on the accountants' part can destroy the basic purpose of accounting measurement.'

The draft statement, paras. 4.40–4.50, discusses the issue of the 'hardness' of accounting measures (without using the term), but fails to exhibit any awareness of the implications of agency and transactions costs theories for such issues. These relate particularly to the problems arising from information asymmetry between management and financial statement users, and the possibility of opportunistic behaviour on management's part. Accounting (together with auditing) is an important form of 'monitoring'—the term employed by agency theorists to refer to the scrutiny of management's activities in order to protect investors' interests. Excessive 'measurement slack' allows managers to manipulate the information provided for this purpose, in ways to which auditors typically will not be able to raise effective objections; hence the destructive consequences for the basic purpose of accounting measurement noted by Ijiri.[2]

Research has indicated that 'measurement slack' is a particular problem with FVA. A major pitfall (and this was true for SSAP 16) lies in the incompleteness of markets. In the absence of secondary markets for many types of asset, how is fair value to be ascertained, and how is the reliability of proxy measures (such as those obtained for current costs using indexation-based methods under SSAP 16) to be judged? To quote from Archer and Steele (1984:85):

> 'With regard to fixed assets, we suggest that it is helpful to recognise that they belong to one of two categories:
> 1. Those for which active secondary (second-hand) markets exist or to which an identical (or very similar) asset can be purchased new at a known price;
> 2. Those for which the above-stated conditions do not apply.
> .....For the second category, the current cost of an asset which is not new is a theoretical construct with no market equivalent.[3] Since there is no market equivalent, there is no means of checking the accuracy of any calculation of current cost. Strictly speaking, current cost is indeterminate.'

Given the applicability of such remarks to current replacement cost, similar comments could be made regarding the broader concept of fair value to the business (ED, *Statement of Principles*, para. 5.23) for such fixed assets, which also includes net realisable value and economic value in use (EV). In effect, 'fair value' for such assets can only mean the latter; and EV is a measure notoriously lacking in 'hardness'. As Barth and Landsman (1995:101) put it:

> '[F]air value accounting based on value-in-use will be the most difficult to implement because estimating value-in-use involves incorporating firm-specific and potentially private information.'

These issues are partly acknowledged in para. 5.28 of the ED. However, the ASB appears to be optimistic about the development of secondary markets in such a way as to reduce significantly the difficulties just discussed.

A more recent Australian study of current value accounting (Jones and Love, 1995:282) concluded:

> [T]he wider acceptance of CVA practices in Australia will be continually dogged by business concerns into its implementation..... Much of the CVA literature to date has tended to focus on the decision relevance of different valuation philosophies, the analytical refinement of measurement techniques, and the conceptual weaknesses of conventional historical cost accounting. However, ...more intensive systematic research efforts devoted to identifying and overcoming the implementation problems of CVA [are] pressing issues...'.

In the context of research carried out in the US, Barth and Landsman (1995:98n) put the matter as follows:

> 'Although the FASB's present fair value focus is on financial instruments,... the most important attribute of an asset as it relates

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[2] A somewhat similar argument against the use of FVA in financial reporting is presented by Fearnley and Page (1996). These authors make the agency-theoretic point that: '...if you are running your own business, it is fine to work out how much to pay yourself on the basis of your estimates of the business's future cash flows and the current value of its assets, but if you are employing people to run the business for you it is not a good idea to pay them on the basis of their estimates of the business's future prospects because then they would have an incentive to over-estimate.' (Fearnley and Page, 1996:94).

[3] It is the present value of the stream of annual equivalent costs avoided by owning and not having to acquire the asset (Archer and Peasnell, 1984:116).

> to fair value accounting is whether an estimate of its fair value is readily obtainable, either because active markets exist for it or there are accepted techniques for estimating its fair value. Nonetheless, in practice, often it is more difficult to obtain fair values for non-financial assets because they typically are not actively traded nor are there accepted techniques for estimating their fair values.'

Given market incompleteness and the agency theoretic issues relating to 'hardness' and 'measurement slack', the superiority of FVA over the historical cost model (with indexation in case of significant inflation) cannot therefore be taken for granted on grounds of decision relevance[4]; nor has it been plausibly argued that the additional benefits of fair value-based accounting information exceed its additional costs.[5] By contrast, there are solid grounds for believing that FVA would provide a paradise for creative accounting. Moreover, recent research (e.g. Bouwman, Frishkoff and Frishkoff, 1995) suggests that improvements (both quantitative and qualitative) in *segment information* would be greatly welcomed by professional users of financial statements. There would appear to be no comparable enthusiasm on the part of users for fair value information.

I am not seeking to deny that fair value-based information has a role in financial reporting; but for the reasons indicated above, its role may be considerably smaller than the whole thrust of the ED would have us suppose. For example, it may be confined mainly to financial assets and liabilities and to real estate with an active secondary market. This is a major issue, which the ED simply begs.

There is evidence that in a financial reporting environment characterised by semi-strong informational efficiency of capital markets, accounting standard-setters would do better to devote more attention to improving disclosure, and less to trying to resolve normative issues of accounting measurement (Beaver, 1989, ch.6). This, indeed, is what professional users appear to want. In particular, there is evidence cited earlier that more disaggregation of profit, cash flow and asset/liability information by business segment, and of cost information into fixed and variable categories, would be welcomed by analysts.

If the ASB wishes to promote FVA, then it should:

1. Provide evidence that having substantially more FVA-based information in financial statements is a high priority for financial statement users;
2. Identify categories of item for which active markets exist so that fair value measures can be produced with an acceptable degree of 'hardness'; and
3. Establish a programme for producing FVA measurement standards for each of these categories of item.

3. Issues of recognition and of interrelationships between financial statements

3.1. The Nature of Assets and Liabilities and the Relationship Between the Income Statement and the Balance Sheet

The essence of the 'matching-attaching' paradigm from which the ASB seems at times to be trying to escape is not historical cost per se as a measurement principle. Rather, it lies within the nature of the recognition criteria for assets and liabilities. As the US Accounting Principles Board put in its Statement No. 4 (APB, 1970:24–25), within that paradigm:

> 'assets...[and]...liabilities...are economic resources...[and] economic obligations ... that are recognised and measured in accordance with generally accepted accounting principles. *Assets and liabilities also include items that are not economic resources or obligations but which are recognised and measured in accordance with generally accepted accounting principles*' (emphasis added).

The main problem the APB faced was accountants' tendency to interpret 'matching-attaching' as justifying the deferral as 'assets' of certain costs which arguably provide economic benefits (or 'value potentials') applicable to future periods but which do not represent either 'resources controlled by [the] enterprise' (IASC, 1989b), or rights to such resources. The IASC itself, having proposed as its 'preferred treatment' in E32 (IASC, 1989a) that development costs should no longer be recognised as assets, was obliged to reverse its position and to accept recognition as an asset subject to specific criteria (the 'alternative treatment' in E32) as its *preferred* treatment. The 'specified criteria' do *not* include the existence of transferable intellectual property rights, because when *that* criterion is met the asset is a patent.

The ASB's position on this issue is not clear. Para. 3.10 of the ED, *Statement of Principles*, mentions 'unpatented inventions' as an example of 'an asset [which] may exist in the absence of legal rights'. Is 'unpatented inventions' a term for development costs that meet certain criteria not including the existence of legal rights? Para. 3.18 also allows for 'assets' of which the enterprise cannot dispose, provided they can be 'separately identified from the business as a whole'. Whether such separate identification must be physical or legal, or whether it may be merely conceptual (as in the cases of development costs, or of brands for which no secondary market exists), is not explained.

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[4] As Barth and Landsman (1995:98n) put it: 'In the more realistic setting, measurement error in fair value estimates exists, affecting their relevance.'

[5] The costs and the benefits do not necessarily affect the same parties. However, this does not imply that it would be justifiable to require information to be disclosed when the costs of doing so would exceed the benefits.

For the balance sheet to play a role beyond that of a depositary for deferrals and accruals between income statements within the 'matching-attaching' paradigm, it is not necessary to move to fair value accounting; it would suffice that deferrals and accruals be recognised as assets and liabilities only when legal rights to economic resources or services, or legal obligations to transfer such resources or services, attach to them. The recognition of assets and liabilities that do not meet this criterion is essentially a form of 'income smoothing'.

A justification of such smoothing has been offered on the grounds that what are being recognised are value-components (or changes in these) which cannot be captured using more rigorously defined concepts of assets or liabilities because of market incompleteness (Whittington, 1983, ch.3).[6] A major problem with this line of reasoning is that it makes the location of the boundary between permissible use of deferrals and accruals on the one hand, and impermissible income smoothing on the other hand, quite arbitrary. In fact, it leads to the definition of accounting income (gains minus losses in the ED's terms) being made circular; a feature of APB Statement No. 4 to which APB member George C. Catlett scathingly referred in his dissent from the Statement (see Archer, 1993:79). The ASB's approach seems to ignore these issues and raises the further problems discussed below.

3.2. The ASB's Treatment of Recognition

The ASB devotes Chapter 4 of ED, *Statement of Principles*, to the topic of recognition. Its treatment of the topic raises a number of problems, including an undesirable conflation of recognition and measurement.

The criteria given for recognising a potential financial statement item rely entirely on the definitions of financial statement elements, and especially of assets and liabilities, given in Chapter 3. Thus, these definitions in Chapter 3 are the 'recognition criteria' in the normal sense of the term; they indicate the rules for a debit or cost item being treated (say) as an asset rather than as a loss or a distribution, or for a credit item being treated as a liability rather than as a gain or a contribution.

But in addition, the Statement's approach to recognition in Chapter 4 does not seem to start in the familiar way with the existence of an item (the result of a transaction or event) whose treatment has to be decided. Recognition according to the Statement involves three stages: initial recognition, subsequent remeasurement and derecognition. Para. 4.6, *Initial recognition*, states (with remarkable opacity):

> 'An element should be recognised if: (a) there is sufficient evidence that *the change in assets or liabilities inherent in the element has occurred* (including, where appropriate, evidence that a future inflow or outflow of benefit will occur); and (b) it can be measured at a monetary amount with sufficient reliability' (emphasis added).

Paras. 4.11–4.14, *Past events*, clarify the situation somewhat:

> '*Recognition is triggered when a past event gives rise to a measurable change in the assets or liabilities of an entity*.....[R]ecognition of one element, or of a change in an element, will inevitably result in the recognition of another element or change....Many recognised elements are the results of past transactions ...Some elements, however, are recognised as the result of other events...' (emphasis in original).

However, the importing of measurement (and 'remeasurement') into the recognition process has the undesirable effect of conflating recognition and measurement. As I have argued elsewhere (Archer et al., 1995:13), recognition (i.e. the process of deciding that an item satisfies the criteria for membership of a particular category of element) is *logically prior* to measurement: logically, one decides on recognition and then one measures what has been recognised. It may be possible to 'measure' items (e.g. on the basis of historical cost) that do not meet the recognition criteria, and thus 'measurability' per se is *not a sufficient condition for recognition, although it is a necessary one.* Moreover, how can 'subsequent remeasurement' be part of the recognition process?

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[6] ED, *Statement of Principles*, para. 42 acknowledges that '[a] balance sheet does not purport to show the value of an enterprise', and refers to the omission from the balance sheet of some assets and liabilities for reasons 'stemming from reliability of measurement and cost-benefit considerations'. With imperfect and incomplete markets, however, another major reason is the so-called 'aggregation problem', i.e. that asset values may not be additive. In addition, the reference to assets and liabilities 'not...being included in a balance sheet' suggests that the ASB is overlooking the distinction between value-components that meet the criteria for recognition as assets or liabilities, and those which do not (e.g. components of goodwill). Given the attention paid to this distinction in the goodwill and other intangibles project, such an oversight in the ED is surprising.

From para. 4.24, it appears that what the ASB has in mind is the recognition of unrealised holding gains and losses:

> '*Some of the events that trigger subsequent remeasurement involve the remeasurement of the flow of benefits associated with an asset or liability*....[W]hile [some] change[s] in value [are]...candidate[s] for recognition, not all such changes are recognised. Whether or not a change is recognised will depend on the particular circumstances of each case' (emphasis in original).

The implication would seem to be that, when 'remeasurement' can be carried out with sufficient reliability, then it should be carried out (subject to materiality and in some cases prudence). No attempt is made to establish that such 'remeasurement' is cost-effective, i.e. that it provides information whose value exceeds its cost.

3.3. The ASB's Proposed Treatment of Gains and Losses in Two Separate Statements

The elucidation of the concept of comprehensive income is one of the more valuable products of the FASB's monumental, yet largely intellectually sterile, conceptual framework project. However, the practical implementation of this concept in financial reporting raises a number of problems. The ASB's attempts to deal with these in ED, *Statement of Principles*, achieve only limited success.

Paras. 6.18–6.33 eschew a single statement of comprehensive income in favour of a system of two 'statements of financial performance': a 'profit and loss account' (gains and losses from 'operating' activities) and a 'statement of total recognised gains and losses' (gains and losses on assets and liabilities 'held on a continuing basis primarily to enable the entity's operations to be carried out').

It would have been helpful if we had been given more details about the rationale, functioning and interrelationship of these two statements. Relevant matters have been discussed in the recent US research literature, such as Barth and Landsman (1995:104) and Johnson, Reither and Swieringa (1995). In particular, a major issue is whether there is a subset of the components of comprehensive income, sometimes called 'core earnings', which ought to be distinguished and which could be reported in a separate statement. As Barth and Landsman (1995:104) cautiously note:

> 'It is possible that a partition of income based on operating versus non-operating activities is informative if operating earnings have different value implications than non-operating [income], e.g. different risk characteristics, resulting in investors applying different weights to the two components when valuing the firm. However, fair value accounting and the concept of core earnings are unrelated in that the former relates to accounting measurement and the latter relates to disaggregation of recognised amounts. *Thus, standard-setters should consider their concept of core earnings apart from their consideration of fair value accounting*' (emphasis supplied).

Johnson et al. (1995:133) issue a more pointed warning:

> 'At its broadest, a project on comprehensive income could encompass the requirements for *recognition* and *measurement* of income items. Such a project would include a comprehensive re-examination of the present standards for accounting for income items. However, that would be a massive undertaking that would raise a multitude of formidable and complex issues that are sure to be highly controversial. They are issues to which the [FASB] and its predecessors have devoted a large amount of time and effort with only moderate success....In addition, no strong clamour of support for undertaking such a project has been heard from any of the Board's constituents. Accordingly, the [FASB] has concluded that [such] a project ...is not practical at this time.'

The ASB, however, is evidently not to be deterred. Its proposals for reporting comprehensive income are made very much in the context of a project of the kind that the FASB rejected as 'not practical'. It is therefore hardly surprising that these proposals raise more questions than they answer.

Presumably, the ASB's proposed profit and loss account is the statement of 'core earnings', but the criteria for inclusion in this statement are not clear. Leaving the reader to assume that the total of the profit and loss account will be one of the line items in the statement of total recognised gains and losses (STRGL), para. 5.25 states that these statements should 'report only the gains and losses that arise during the period'. Veterans of current cost accounting will immediately wonder where holding gains on stock (inventories) are to be reported. If recognised in respect of stock held during the period before sale (i.e. as unrealised holding gains), should they appear in the profit and loss account or only in the STRGL? The wording of paras. 6.27 and 6.28 suggests that they should appear in the former, while their realisation on sale would be reported only with historical cost-based information in the notes (para. 6.24).

It is probably wise of the ASB to propose reporting unrealised holding gains/losses on stock in the profit and loss account, given that the achievement of such gains is an outcome of operating decisions regarding the timing of purchases and economic stock levels. But cannot the same be said of unrealised holding gains/losses on non-current items such as property (the outcome of a management decision to buy rather than to rent) or fixed interest debt (the outcome of a treasury management decision to offer a fixed rather than a floating rate)? The exclusion of such items from 'core earnings' requires more explanation and justification than the ED provides.

These considerations, linked to the difficulties of defining 'core earnings', call into question the soundness of separating the profit and loss account from the statement of total gains, rather than using a single statement of comprehensive income, within the kind of framework which the ASB is proposing.

Perhaps the explanation for the ASB's choice lies in the fact that the Board's intention regarding the recognition of unrealised holding gains/losses for particular categories of asset or liability is that they should be recognised as and when the measurement problems acknowledged in paras. 5.28 and 5.38 are overcome (this decision being apparently left to individual entities).[7] It is, however, hard to see how such an ad hoc approach could improve the financial statements' information quality.

In addition to the issue of 'hardness' (see Section 2 above), there are also those of cross-sectional and longitudinal comparability. The ASB's arguments as to why the dichotomy of gains into 'operating' and 'holding' is of benefit to financial statement users are aprioristic in character, and make no reference to the empirical research literature that suggests it is the time-series property of *persistence* of an earnings component, not whether it is 'operating' or 'holding', that is value-relevant (Beaver, 1989, ch.5).

As those of us who have tried to estimate operational gearing know, there is a dichotomy (related to persistence) which would be of much more use to financial analysts: namely, that between variable and fixed expenses (see, for example, Lord, 1995:319). Published financial statements in Denmark used to disclose variable and fixed expenses separately; this was abandoned when the EC's Fourth Directive was implemented in Denmark, to the detriment of the profit and loss account's usefulness (Christiansen, 1995:126–7). In this respect, therefore, as with its relative neglect of segmental information, the ASB as it presents itself in its ED Statement of Principles can hardly claim to be 'the financial statement users' friend', since its approach to financial reporting places dogma before an informed sensitivity to users' needs. Instead, on the basis of the ED, the ASB looks much more like being 'the creative accountants' friend'.

4. On the idea of a conceptual framework and the ASB's Statement of Aims

4.1. The ASB's Approach to Developing a CF

The failure of the FASB's conceptual framework project to achieve any significant *succès d'estime* has evidently not deterred other standard-setting bodies such as the International Accounting Standards Committee and the ASB from issuing or seeking to issue statements setting out a conceptual framework, albeit at much less length than the set of six Statements of Accounting Concepts produced by the FASB. It is understandable that standard-setting organisations continue to feel the need for some body of theory on which to ground their prescriptions. Yet what they come up with is statements of NAT, which beg the question as to their own authoritative character. To be sure, statements of accounting standards are essentially normative, in that, as well as being prescriptions, they embody value judgments as to what methods of accounting are desirable. However, a characteristic of NAT has been a failure to spell out adequately the criteria in the light of which the value judgments as to the desirability of accounting methods are to be made.

Mattessich (1995, ch.11) suggests that a major weakness of NAT is the failure of normative accounting theorists to place their prescriptions within a framework of means-end relations (instrumental hypotheses) in which the means are related to, and conditional upon, the ends pursued. This point is discussed further below, with particular reference to the issue of 'economic consequences'.

The ASB states on p.7 of its *Statement of Principles* that the ED has been produced in accordance with its Statement of Aims, which include 'developing principles to guide it in establishing standards and to provide a framework within which others can exercise judgment in resolving accounting issues'. The principles in question could be of two types, which need not be mutually exclusive.

1. Principles of normative accounting theory; and

2. Methodological principles.

With regard to the former, one of the problems of accounting theory has been a failure to distinguish between rules and principles (Archer, 1993:88). In the literature on legal theory (jurisprudence), the distinction is that principles are *meta-rules*, or higher-order rules that govern a set of lower-order rules. The ASB's 'principles' contain a number of rules of recognition and measurement that are lower-order rules rather than principles as found in legal theory. The latter are generally of the nature of methodological principles, such as the principle of *stare decisis* or legal precedent.[8]

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[7] A referee of an earlier version of this paper commented: 'Is it not obvious that the ASB is trying to work with the existing P&L and building onto it a comprehensive income statement? Here there is a clear [incrementalist] politics of working with what already exists and is accepted.' However, the logic of an incremental approach, (famously characterised by Lindblom (1959) as 'the science of "muddling through" ') may not be obvious (see Archer, 1993:81–83).

Another difference between 'principles', as understood by the ASB, and methodological principles is the consideration that may be given to what have been termed the 'economic consequences' of accounting standards. Various accounting thinkers (including some as illustrious as Stephen Zeff and David Solomons) have taken the view that to allow economic consequences to become important criteria in accounting standard-setting is objectionable, since it leads to the subordination of accounting principles to pressure group politics. Yet experience shows that a conceptual framework for accounting standard-setting that takes no account of likely economic consequences fails to provide the standard-setter with effective protection against pressure group politics, as Dopuch and Sunder (1980) pointed out.

This was true, for example, of the US conceptual framework and the overriding of SFAS 19 (*Financial Accounting and Reporting by Oil and Gas Producing Companies*) by SFAS 25. In addition, SFAS 14 (*Financial Reporting for Segments of a Business Enterprise*) was so framed as to allow reporting entities considerable latitude in reporting, which seriously detracts from the usefulness of the resultant information. Moreover, the IASC's framework was ineffectual in that it did not enable the IASC to adhere to its plan, stated in E32, to make the expensing of R&D costs (as in SFAS 2) its preferred method.

One does not need to subscribe to Watts and Zimmerman's (1986) 'market for excuses' theory of the origins of NAT in order to understand the reasons for that failure. The essential reason is that accounting standards are liable to have economic consequences, and NAT by its nature has treated such consequences as externalities.

By contrast, methodological principles can incorporate consideration of economic consequences into a framework of due process. As I have argued elsewhere (Archer, 1993:106–111), the ability to show that such consequences had been carefully considered and weighed in reaching a proposed standard would add to the standard-setter's authority and provide protection against the effects of lobbying by pressure groups. One does not protect oneself against such lobbying by relying on a set of principles that deliberately excludes consideration of economic consequences.

It has been suggested (Dopuch and Sunder, 1980) that private sector bodies such as the ASB may have no legitimate authority for making decisions involving economic consequences; hence, such bodies may be obliged to act as though such consequences are irrelevant to their decisions. If this is true, then it should be clear that the efficacy of such bodies faces a major obstacle. Dopuch and Sunder also suggest that, for such bodies, a conceptual framework of NAT acts as a kind of ideological figleaf (see also Archer, 1993:91).

One major weakness of NAT as espoused by the ASB lies in its interpretation of the 'objectives of financial reporting' in terms that appear to involve reification of accounting measures such as profits and asset values. In other words, what seems to be assumed is some *objectively existing* 'economic reality' that financial statements are supposed to 'present fairly', or of which they should give a 'true and fair view'; NAT (as espoused by the ASB) is concerned with how this is to be achieved. From such an external realist perspective on accounting, what matters is whether an accounting method is conducive to the 'representational faithfulness' of financial statements, and it is assumed that if the process of standard-setting leads to financial statements being 'representationally faithful', then this constitutes a fair and just outcome.

Yet, as several writers have pointed out (e.g. Ijiri, 1975; Hines, 1988; Archer, 1996) 'economic reality' does not exist 'objectively', in the sense of existing independently of the social actors who collectively experience it and contribute to it. In epistemological terms, it is intersubjectively constructed by the social actors in question. Accounting concepts and methods are crucially implicated in this process of intersubjective construction. Given that in general no objective, external realist criterion of 'representational faithfulness' is available for evaluating an accounting method, it is hard to see how normative accounting theorists can be justified in excluding issues of economic consequences and their fairness from the domain of their theory. This is not to say that intersubjectively constructed reality is 'not real'; see, for example, Putnam (1981:49–50) on 'internal realism'. For an interpretation of the notions of 'fair presentation' and 'a true and fair view' from an internal realist perspective, see Archer (1996:58–60).

Returning to Dopuch and Sunder's (1980) point about legitimacy, however, standard-setting bodies may feel more at ease with an external realist criterion of 'representational faithfulness', as this seems to provide them with an epistemological basis for claiming to occupy a 'neutral' standpoint away from 'political' concerns for economic consequences. If this involves an inappropriate and ultimately stultifying view of the relationship between accounting and reality, *tant pis*.

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[8] Accounting rules such as the requirement to provide a 'true and fair view' or (alternatively) 'fair presentation' may be considered as meta-rules (Archer, 1996:55).

In the light of these considerations, I believe that principles of the type set out in the ED will be of limited value to the ASB and the accounting profession (c.f. Gaa's critical comments on the FASB's SFAC 5; Gaa, 1988:154). To be sure, a standard-setting body needs some set of criteria to help it achieve a degree of consistency in its use of accounting concepts. It is no doubt appropriate for the Board to be developing a set of such criteria. But the Board appears to be making the double error of incorporating a questionable preference for FVA into its proposed principles, while assuming that its Statement of Aims will be satisfied as regards the development of principles by issuing statements of normative (and tendentious) accounting theory.

Another misgiving about the ASB's approach to developing a CF arises from the title of Chapter 1 of the ED, 'The objective of financial statements'. As Dopuch and Sunder (1980) and Gaa (1988) have pointed out, 'the concept of an objective is unclear when applied to an activity (i.e. financial reporting) rather than to individuals or groups. People have goals and objectives motivating them to perform their activities; but the activities themselves do not have goals or objectives' (Gaa, 1988:148). A similar comment could be made regarding the attribution of objectives to financial statements.

However, while it is problematic to attribute objectives to an activity, rather than to the individuals who carry out that activity, it may be appropriate to speak of an activity having a purpose, and of an artefact such as a building or a tool being designed for a specific purpose. The purpose of the artefact reflects the objectives of its designer in designing it for that purpose; but it could be used for other purposes (e.g. a tool may be used as a murder weapon). In that sense, a set of financial statements and notes (a 'financial reporting package') could have a purpose; this would reflect the objectives of the 'package's' designers (c.f. Mattessich's 'conditional-normative accounting methodology' (Mattessich, 1995, ch.11)). This raises the question of how a CF could serve in guiding the design of such a 'package' and its components.

4.2. *Alternative Methodologies for a CF*

Power (1993) has pointed out that to consider a CF as a body of theory from which accounting standards are to be derivable in a normative-deductive manner is to take an unduly *scientistic* view of accounting standard-setting. Observation of accounting standard-setting in various countries suggests that accounting standards are rules established as *social conventions*, the authoritative character or validity of which results from the legitimacy of the process whereby they are developed and promulgated (Archer, 1994, 1996). Therefore, a conceptual framework in the form of NAT is inadequate as a source of authority for accounting standards. Rather, what may be needed is a framework that establishes the standard-setting process in a manner which conforms to Rawls' (1971) notion of 'procedural justice', i.e. that they result from following procedures that are recognised as generally producing just outcomes.

Rawls (1971) distinguishes between three forms of procedural justice: perfect, imperfect and pure. In the case of imperfect procedural justice, there is no perfect procedure for ensuring a just outcome, but there are imperfect procedures (such as the due process of law) which go substantially towards this, and also for subjecting outcomes to review and potential revision (e.g. appeal procedures).

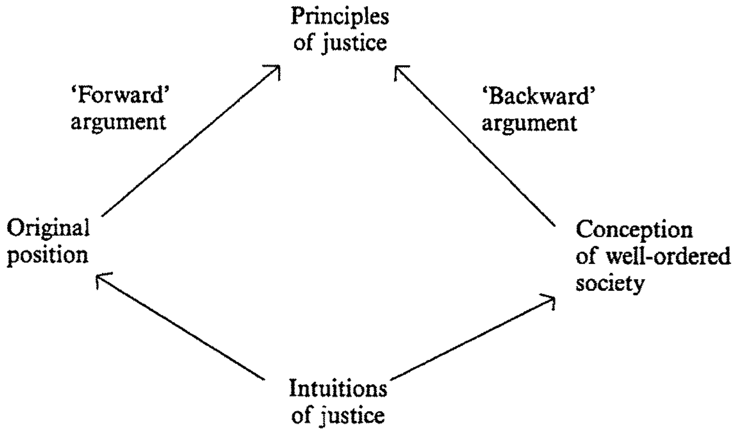
The validity of financial accounting standards may be thought of as a matter of imperfect procedural justice, and this could apply even when they lacked legal backing, for the following reasons. On the one hand, in the case of financial reporting, it would seem that an independent criterion as to whether outcomes are just is available, namely the meta-rule of 'providing a true and fair view' (or, alternatively, that of 'fair presentation'). On the other hand, since the application of this meta-rule is subjective, there is no guarantee that the just outcome (e.g. fair presentation) will result. The situation therefore fits neither perfect nor pure, but *imperfect*, procedural justice. In the absence of a criterion such as 'fair presentation', we would be left with pure procedural justice, a less satisfactory situation (Archer, 1996; see also Gaa, 1988:136–7).

Nevertheless, there could be a role for a different kind of CF, as suggested by Power (1993), Gaa (1988, chs. 7 and 8) or the present writer (Archer, 1993). For Power, the role of a CF is to 'establish general criteria that...provide boundaries or limits to the process whereby particular judgments are made...and guide the process [of standard-setting] by giving a structure to the communicative processes involved'. These general criteria reflect 'intuitions of accountability and accounting' (Power, 1993:55–6).

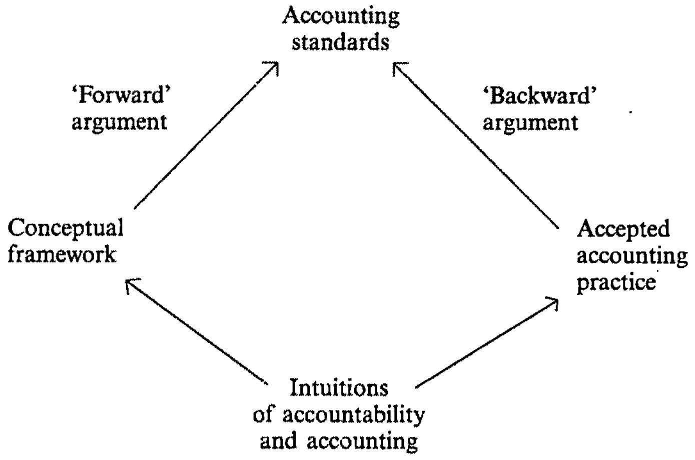
Somewhat similarly, for Gaa a CF has a role to play within a 'codificational' approach to the methodology of standard-setting. In such an approach, accounting standards are developed as a codification of accepted accounting practices in the light of considered judgments about such practices, a process that includes removing conceptual inconsistencies and weeding out existing practices that are discrepant, and which is guided in this by a CF.

From this perspective, what the ASB and similar bodies need is not just a CF, but rather a larger

Figure 1
'Reflective equilibrium' for financial reporting



Rawls' model of 'reflective equilibrium'



Source: Power (1993, pp. 52 and 56)

epistemological model into which a CF fits and plays a role. An idea of such a larger model is provided by the bottom panel of Figure 1, which depicts Power's use of Rawls' model of reflective equilibrium. In this model, the CF is shown as 'exerting a normative influence within the reflective equilibrium process [with its] dual "backward" and "forward" argument structure' (Power, 1993:56).

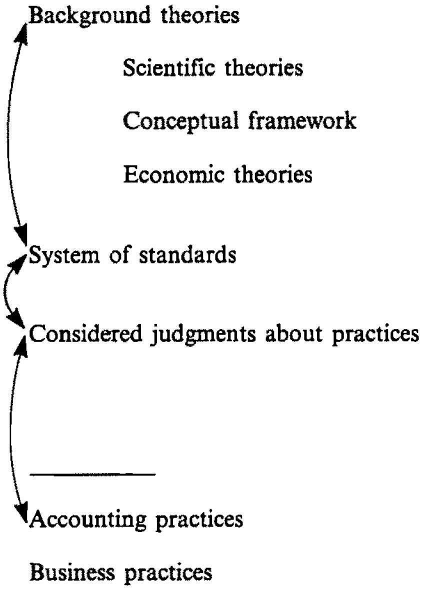
The deductive 'forward argument' starts from an 'original position', which 'interprets our moral intuitions as "disassembled" parts of some construction' that is both grounded in, and grounds, actual practices; this provides deductive inferences regarding the need for, and acceptability of, particular accounting standards. In turn, the body of accepted practices provides a basis for inductive 'backward arguments' on the same issues. In this sense, Rawls' theory of reflective equilibrium provides a framework for '(re)constructing commonly held intuitions' (Power:52–3).

Gaa (1988:125–6) provides a different but comparable model in which a CF forms part of the 'background theories' within a larger epistemological model of the reflective equilibrium process of financial accounting standard-setting.

While Power leaves open the question of how 'the economic consequences view' would fit into his model, stating that it is a task for the future, Gaa is prepared to go further:

> '[S]uppose that action in accordance with a standard (which was chosen based on a given set of reasons) turns out to have unaccept-

Figure 2
Hierarchical relationships in the codification of financial accounting standards



Source: Gaa (1988 p. 125)

> able consequences. The standard-setter may choose to re-examine the acceptability of the reasons which originally provided its justification....The reflective equilibrium nature of the process of codification...[that is,] the process of justifying both the financial accounting standards and the underlying theory "is the delicate one of making mutual adjustments" between theory and practice (Goodman, 1979:64)....*An accounting theory, of whatever kind, is not logically sufficient for justifying the promulgation of an accounting standard*....It must be emphasised that the decision to promulgate (or to refrain from promulgating), amend or rescind a financial accounting standard is *basically an ethical judgment on the part of the standard-setter*' (Gaa, 1988:127–8, emphasis supplied).
> '*The side effects [economic consequences] of rules are not...irrelevant*...[even if] the primary task of the standard-setter is to judge the quality of information produced according to the standards' (Gaa, 1988:144, emphasis supplied).

The 'gross balance method' described by the present writer (Archer, 1993:104–5) may also be considered as involving procedural justice and a type of reflective equilibrium process. In particular, step 4 in the four-step method comprises the successive re-evaluation of policy alternatives (e.g. alternative responses to a standard-setting issue) in the light of critical parameters, including personal and political values. The main difference between this methodology and that suggested by Power is as follows: less weight is given to existing practices as a basis for a 'backward argument', while more weight is given to the processes of establishing a reasonable degree of both *agreement* about purposes or ends and *knowledge* as to which practices would constitute effective and acceptable means to such ends. In these respects, my proposals are more similar to those of Gaa, with his emphasis on the role of non-accounting theories and of considered judgments about practices (Gaa, 1988:125).[9]

5. Concluding remarks

I argued above that if, for reasons connected with the perceived limits of their legitimacy, private sector bodies such as the ASB feel obliged to act as though the economic consequences of their actions are irrelevant to their decisions, then the efficacy of such bodies faces a major obstacle. I furthermore suggested that what is needed is a framework that establishes the standard-setting process in a manner which conforms to Rawls' notion of 'procedural justice', i.e., such that accounting standards are outcomes of procedures that generally produce just outcomes.

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[9] Such an approach need not be confined to financial accounting. There is thus some affinity with Mattessich's 'conditional-normative accounting methodology' (Mattessich, 1995, ch.11). However, while he acknowledges that in accounting (as in various other domains) empirical knowledge of causal means-end relationships can be seriously deficient, one may wonder whether Mattessich always accords due weight to this major epistemological problem (see, for example, Mattessich, 1995:83, 195 and 202; c.f. Archer, 1993:100–101).

This implies that the ASB should not attempt to revise the existing ED, *Statement of Principles*, although it should assemble a set of 'background theories' that would need to be 'accepted and amended as a result of the dynamic interplay between them and the standards they help to justify' (Gaa, 1988:127). This would need to be done within the framework of an approach wherein the Board expresses its principles in terms of procedural justice and fairness to legitimately interested parties.

The result would be a document quite different from the ED, perhaps in part resembling an updated form of *The Corporate Report* (Accounting Standards Steering Committee, 1975), but with the following differences. A larger framework would be provided that would not, in the first instance, focus on providing answers to complex issues such as rights to, and obligations to provide, financial accounting information (disclosure), and qualitative characteristics of various forms of such information (e.g. different 'measurement' bases). Instead, this larger framework would first concern itself with specifying the procedures (the reflective equilibrium process) to be used in dealing with such issues.

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Lies, Damned Lies and *More* Statistics: The Neglected Issue of Multiplicity in Accounting Research

R. Murray Lindsay*

Abstract—The problem of 'multiplicity' (and selection) is considered by many statisticians to be among the most difficult and important problems they face. It includes such areas as multiple tests, variable selection in regression analysis, subgroup analysis and data mining. It undermines statistical inference by inflating type I errors well above reported levels of significance. The basic issue confronting researchers is how to adjust inferences to allow for multiplicity, particularly in exploratory or model-building analyses where standard textbook probability calculations associated with estimation and hypothesis testing do not apply. Despite its importance, and unlike what occurs in other disciplines, the multiplicity problem receives little or no attention in accounting. This situation is of concern because survey results suggest that serious type I error inflation is a real possibility in management accounting. In attempting to remedy this situation, the paper adopts a classical statistical framework for the purpose of examining the key issues underlying the problem and to present some strategies for dealing with it. These strategies offer the researcher a reasoned approach that recognises the possibility that the observed results may be due to chance, as well as the possibility that they are real. The discussion also highlights the fact that the only way to deal with the issue of multiplicity successfully is to repeat results on new data.

1. Introduction

Consider the following situation where two independent investigators, A and B, are investigating the relationship between subordinate budgetary participation and job performance using survey data. In examining this issue, A collects measurements for the following predictor (explanatory) variables: participation, task uncertainty (TU), locus of control and supervisory evaluation style. After performing numerous analyses, A finds that TU plays an important moderating influence on the primary relationship, being statistically significant at the 0.04 level. Investigator B performs a more focused investigation and does not collect data on the last two variables. He too finds that TU moderates the relationship between participation and job performance at a similar level of statistical significance. Assuming similar power levels, are both investigators entitled to draw the same conclusion, or does the fact that A has selected TU from more explanatory variables than B affect the actual level of significance attained, i.e., the inference to be made?[1]

Turning to a different scenario, suppose A collects data for the five variables described above for the purpose of conducting two separate studies. In the first study, A wants to examine the moderating effect of locus of control on the relationship between budgetary participation and job performance. In addition, A wants to examine the moderating effect of TU on the relationship between supervisory evaluation style and job performance. With respect to the latter, the results do not support the hypothesis of interest. However, after performing further analyses, A finds that by including participation and performing a three-way interaction between TU, participation, and supervisory evaluation style, a statistically significant result at the 0.01 level is achieved. Should the level of significance be adjusted to reflect the fact that A has engaged in *data mining*, i.e. using the data to determine which of a number of candidate variables to include in an explanatory model?

As another illustration, how does one interpret significance tests in a situation involving variable subset selection (model building) procedures in multiple regression analysis? To take a specific example, Collins et al. (1987) performed a stepwise regression using 15 preliminary predictor variables, seven of which consisted of interaction terms of special interest. Three of the seven interaction

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[1] Although some of the scenarios described here have been reported in the accounting literature, they are presented for illustrative purposes only and have no connection whatsoever with the manner in which the studies were actually conducted.

variables reached statistical significance at the 5% level. The authors interpreted the 'significant' variables in the normal manner, making no allowances for the total number of tests that were implicitly performed. Is this interpretation valid? If not, why are variants of such practices performed all the time (see Lovell, 1983; Chatfield, 1995b)?

The scenarios described above are all examples of the 'multiplicity problem', an issue that has been the subject of considerable controversy in the statistical literature for over 50 years (Saville, 1990). It surfaces in such areas as multiple comparisons, multiple tests, variable selection in regression analysis, subgroup analysis and data mining. It can lead to actual type I error rates being higher than the nominal level of significance specified—and sometimes drastically so—thereby compromising the raison d'être of the test of significance procedure as providing an *objective* safeguard on the number of claims that can be attributed to chance factors (cp. Fisher, 1959:43, 75; Kruskal, 1979:84; Freedman, et al., 1978:502; Ryan, 1985a).

Type I error inflation stems from two closely related factors. The first is the inflation that is caused simply by the fact that numerous tests of significance are conducted. The number of false significances increases with the number of tests performed as a direct consequence of the pyramiding of error probabilities. The second factor involves the *selection* effects associated with exploratory or model-building analyses.

With respect to the second factor, it is 'well known' that standard textbook calculations of probabilities associated with estimation and hypothesis testing are only valid when a priori theoretical considerations underlie the decision to test a particular model (Lovell, 1983; Picard and Cook, 1984; Berry, 1988). However, to suggest that researchers should behave strictly according to the classical rules is both unrealistic and unproductive. It is unrealistic to suppose that most analyses can be completely specified in advance (Cox and Snell, 1981:25; Chatfield, 1995a:81). This is undoubtedly true in behavioural accounting, where much of the research is exploratory in nature (see Lindsay, 1993a). It is unproductive because following up unanticipated features is not only a valuable use of the data, it is a fundamental aspect of science—it provides researchers with potentially valuable hints or leads.[2] Nonetheless, the concern remains that inferences cannot ignore the selection process that led to the unexpected discovery.

In both cases, the issue becomes how to adjust p-values (inferences) to account for multiplicity and selection—an area where 'more guidance is badly needed' (Chatfield, 1995a:81). Indeed, Berry (1990) considers multiplicity to be among the most difficult and important problems that statisticians face. Yet despite its importance to statistical inference, the multiplicity problem has received little or no attention in accounting research. This is in contrast to disciplines such as psychology, where the issue receives advanced methodological attention in journals and is routinely dealt with by many researchers (see Gaito and Nobrega, 1981; Sedlmeier and Gigerenzer, 1989). This neglect is all the more serious because survey results (reported below) suggest that non-trivial type I error inflation is a real possibility in management accounting.

This article adopts a classical statistics orientation in presenting an overall framework and some specific statistical approaches for dealing with the problem of multiplicity. Although falling short of solving the problem, the discussion provides the researcher with a reasoned approach in recognising the possibility that the observed results may be due to random variability as well as the possibility that they are real. In the end, this is likely the best that can be achieved in dealing with this difficult issue (cp. Berry, 1990).

The balance of the paper is organised as follows. Section 2 examines the type I error inflation associated with the issue of multiplicity. Following this, Section 3 presents the results of a survey aimed at examining the ubiquity of significance tests in managerial accounting research, and researchers' awareness of the multiplicity problem. Next, the statistical controversy associated with the issue of multiplicity is outlined in Section 4 by way of examining the two competing conceptual units for calculating error rates. From a practical standpoint, this examination will show that dealing with multiplicity translates into assessing the relative importance of type I versus type II errors in each particular study. The discussion then leads to a consideration of the basic issues involved in striking an appropriate balance between the two error types. Section 5 then presents two statistical approaches aimed at providing a useful strategy for dealing with multiplicity and, in particular, balancing the two types of errors in a manner appropriate to the researcher's study objectives and circumstances. Concluding comments appear in the final section.

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[2] A popular misconception about science is that theories arrive fully-formed for testing, leading to the considerable importance placed on the philosophical distinction between discovery (exploration) and justification (confirmation). However, a more realistic account of science considers the critical interplay between exploration and confirmation, whereby theories, facts (observations), intuitions and hunches exert a constant influence on each other in the *development* of theories within a research programme (see Rosnow and Rosenthal, 1989; Lindsay, 1995).

2. Type I error inflation associated with the multiplicity problem

The purpose of this section is to illustrate and explain type I error inflation caused by multiplicity and selection in the context of two research situations that are frequently encountered in accounting: multiple group comparisons and variable subset selection in multiple regression.

2.1. Multiple Group Comparisons

When only two group means are being compared, the probability of making a type I error corresponds to the specified critical level of significance (α). However, this is not the case when the number of groups (k) increases beyond 2. For example, if $k = 6$, there are $k(k-1)/2 = 15$ different pairs of means that may be compared. If all samples come from the same population (i.e. the overall null hypothesis is true) and each pair is tested at the 5% critical level, the probability of making one or more type I errors rises to 0.40. For $k =$ 3, 10 and 20 the corresponding error rates for obtaining at least one spurious rejection when the overall null is true are 0.13, 0.60, and 0.90, respectively.[3] Therefore, the moral—one that is generally appreciated by many researchers—is clear: as the number of tests increase, so does the probability of obtaining false significances.

However, in exploratory analyses there is often a tendency after examining the data to select a smaller number of 'special' comparisons to test, e.g., testing the largest difference. What is not always appreciated is that selecting the largest observed difference to test is equivalent to testing all contrasts (Ryan, 1959:32; Myers, 1972:356; Tukey, 1977a:681). As Selvin and Stuart (1966:21) explain: 'If we decide, on the basis of the data, to discard one or more variables from an explanatory relation, we cannot validly apply standard statistical procedures to the retained variables as though nothing had happened. In the nature of the case, the retained variables have had to pass some kind of preliminary [selection] test (possibly an imprecise intuitive one) that the discarded variables failed. In our picturesque terminology the fish which don't fall through the net are bound to be bigger than those which do, and it is quite fruitless to test whether they are of average size' (brackets added). Thus in the example with $k = 6$ groups, the difference between the largest and smallest group means would be declared significant at the 5% critical level approximately 40% of the time (in the long run) even though the overall null is true (Kirk, 1968:78).

The upshot is that the t distribution is no longer valid when certain comparisons are selected from a larger set on the basis of viewing the data (Cochran and Cox, 1957:74). Instead of a random difference, it is the *range* of k random means that is being tested, requiring that the probability assessment consider the inherent *selection* process that has occurred. As k increases, the critical rejection value needs to increase to maintain a legitimate 5% tail-area probability (Snedecor, 1946:409). Using the widely popular Tukey multiple comparison method that is based on the sampling distribution of the Studentized range, the difference between the largest and the smallest (i.e. the range) of $k =$ 6 group means actually requires a t statistic of 3.09 or greater to be declared significant at the 5% level of significance (two-tailed), assuming five cases in each group.[4] This is in contrast to a critical value of only 2.064 if a single pair was chosen a priori, i.e. before seeing the data.

2.2. Variable Subset Selection in Multiple Regression

As Chatfield (1995b) describes, models may be specified a priori on the basis of theory and/or prior studies; however, with modern computational power, they are increasingly being determined partly or wholly from current data, using search procedures that have examined a wide range of possible models. Having done this, the researcher then proceeds to estimate and test parameters of the 'best' model (according to some predetermined criterion) using traditional statistical inference techniques that were developed on the assumption that the model is both true and known a priori. This is done despite the fact that it is 'logically unsound and practically misleading' to make inferences using the same data that the model was derived from (Zhang, 1992). In accounting, this situation is often reflected in the use of variable subset selection procedures within multiple regression analysis.

The problem when statistical inference and model selection are based on the same set of data is that the model chosen provides a much more optimistic explanation of that data set than it does for subsequent data sets (Picard and Cook, 1984). Picard and Cook (1984) cite the following passage by Mosteller and Tukey (1977:37) as providing the

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[3] These error rates, requiring special tables, are from Cohen and Cohen (1983:167). In anticipation of what follows, these results do not agree with those obtained by using equation (1) presented later, because the current calculations are based on both independent and non-independent comparisons, whereas the use of equation (1) adopts a simplifying assumption that the comparisons are all *independent*. In general, deriving probabilities for non-independent comparisons is difficult (Kirk, 1968:78).

[4] The conversion from the Studentized range distribution (q) to a critical value of t (t_c) is $t_c=(q_{\alpha,\ k,\ df\ n-k})/\sqrt{2}$ (Toothaker, 1993:33). Tables for critical values of the Studentized range distribution can be found in Hochberg and Tamhane (1987), Toothaker (1993), or Kirk (1995). The first reference includes tables for critical values as high as $\alpha = 0.20$.

Table 1
Results of a simulated example with $n = 100$, $k = 50$*

Method	*Number of retained predictors*	*Model R^2*	*p-value of overall F test*	*Number of predictors with p-values ≤ 0.05*
Full model	50	0.59	0.13	6
Stepwise	16	0.48	<0.001	11

*Adapted from Weisberg, 1985: 215.

most eloquent explanation of the 'Optimism Principle':

> 'Testing the procedure on data that gave it birth is almost certain to overestimate performance, for the optimising process that chose it from among many possible procedures will have made the greatest use possible of any and all idiosyncrasies of those particular data. Sometimes we say that "Optimisation capitalises on chance!" As a result, the procedure will likely work better for these data than for almost any other data that will arise in practice.'

When selection is present, exact distributional results are virtually impossible to obtain, even for the simplest of common subset selection algorithms (Picard and Cook, 1984). There is little theory to guide us, and the biases that result are not well understood (Copas, 1984; Chatfield, 1995b). Yet the simulation research that has been done is consistent in its conclusion: the use of standard statistical techniques that assume a known (a priori) model can lead to erroneous conclusions. Several studies have shown that high model R^2s and statistically significant t statistics are almost inevitably produced when the researcher uses search procedures for selecting the 'best' subset of explanatory variables—even when the dependent and independent variables are completely unrelated (Rencher and Pun, 1980; Freedman, 1983; Lovell, 1983; Flack and Chang, 1987).

To take a specific example that is typical in the statistical literature, Weisberg (1985:214–215) generated an independently-drawn data set consisting of 100 cases with a single response variable Y and $k = 50$ predictor variables using standard normal random deviates so that the regression coefficients $B_{k=1,2,\ldots,50}$ and the true multiple correlation between Y and the Xs were all known to be zero. His findings for the regression of Y on the 50 predictor variables is presented in the first row of Table 1. The value of R^2 is 0.59, the p-value associated with the overall F-test is 0.13, and six predictors have statistically significant p-values at the 0.05 level. The second row of Table 1 summarises the final model after running forward stepwise regression to select the 'best' subset of predictor variables. Sixteen predictors are retained, resulting in the model R^2 dropping to 0.48. However, the overall model reaches significance at less than 0.001, and 11 of the predictor variables are now significant at the 0.05 critical level of significance.

The moral is therefore clear; selection procedures can grossly overstate the apparent significance of results! When one uses a selection process to select the 'best' subset of predictor variables; the F distribution, or anything remotely like it, does not apply (Draper et al., 1971; Pope and Webster, 1972; Miller, 1990). As Draper et al. (1971) explain, the F test is carried out by comparing the extra regression sum of squares for the entered variable with the residual sum of squares. However, in subset selection procedures like stepwise regression, the numerator is selected on the basis of being the largest of all the numerators that could have been selected, a situation analogous to testing the largest observed difference within the remaining set of k variable means.

In addition, this example illustrates how a model's R^2 can be large even for totally unrelated variables. Without selection, the expected R^2 value for a sample drawn from a population in which all correlations between Y and the predictor variables are zero is $k/(n\text{-}1)$ (Cohen and Cohen, 1983:106; Freedman, 1983).[5]

To make matters worse, there is also another form of selection bias that surfaces in almost every regression analysis. After obtaining a satisfactory model that is parsimonious and theoretically defensible—either on the basis of a priori considerations and/or data-dependent selection procedures, the next step in any analysis is to undertake diagnostic checks such as: (i) adjusting for outliers and other influential observations; and (ii) transforming one or more variables for the purpose of achieving linearity, normality and/or constant variance, i.e. meeting the basic assumptions of linear regression. This leads to the situation where inferences are made on the *same* set of data that were used to both select *and* check the model. As Chatfield (1995b) concludes, the end result is that an analyst may in effect be considering tens, hundreds or even thousands of models in search for the 'best' model. Thus, it should not be surprising that 'good' models are reported all the time in the literature.

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[5] When using stepwise regression procedures, Miller (1990) recommends using Rencher and Pun's (1980) tables for comparing the observed R^2 with a value that could have reasonably arisen by chance if there were no real relationship between Y and any of the predictor (X) variables.

No doubt many accounting researchers recognise that the use of search procedures in multiple regression is fraught with danger, although the magnitude of the bias created is likely to be underestimated (cp. Freedman, 1983:152); in addition, statistical textbooks and statistical package manuals are not remiss in warning users of the inaccuracy of calculated probability levels. Yet any evidence that this knowledge is applied in accounting is all too uncommon. Rarely are readers of a research report warned of this problem; nor do researchers gross up significance levels—even crudely—to incorporate not only the selected model, but also those that were rejected; and it is an exceptional occurrence to see results being cross-validated on a hold-out sample, or much better yet, on a new set of data.[6] Moreover, even fewer people are aware of the substantial biases in least squares regression coefficients that occur, in that subset selection methods can introduce biases in the order of one to two standard errors (Miller 1984, 1990). Indeed, Miller (1990:viii-ix) reports a personal experience where some variables that were selected with a t-statistic as large as six or greater had their regression coefficients *reversed* in sign from one data set to another. Moreover, he claimed that this occurred in a data situation that can only be described as being ideal!

In summary, least squares theory does not apply when the model has not been chosen independently of the data that is being used for statistical inference (Lovell, 1983; Miller, 1984, 1990; Picard and Cook, 1984; Hurvich and Tasi, 1990; Chatfield, 1995b). Any inferences made will be biased and over-optimistic because they ignore the selection process that preceded the inference (Chatfield, 1995b). In the context of hypothesis testing, the p-value represents the probability of obtaining a result as or more extreme than the observed result, on the condition that the model is both true and known a priori. However, when selection bias is operating, the true level of significance should be calculated on the probability of obtaining a result as or more extreme than the observed result, given the fact that the model has been selected as best by the model formulation and checking procedure. These two probability distributions may be substantially different (Hurvich and Tsai, 1990). Unfortunately, it is not generally known how to calculate the latter (Chatfield, 1995b), which perhaps explains why p and α values are reported without indication of their pseudoness, to use a term from Pope and Webster (1972). This is an extremely worrisome situation, given the extreme reliance placed by the social sciences on the results of significance tests to discriminate important from non-important findings (see Kruskal and Majors, 1989; Cohen, 1994; Lindsay, 1995).

3. The multiplicity problem in accounting

In order to provide some very preliminary information on the extent of the multiplicity problem in accounting along with an indication of researchers' awareness of it, the author reviewed 43 management planning and control articles appearing in *Accounting Organizations and Society*, *The Accounting Review* and *Journal of Accounting Research* for the years 1970 to 1987 inclusive.[7]

On researcher awareness, the findings are unequivocal in suggesting that researchers do not appear to be concerned about multiplicity. Without exception, no one reduced critical α levels or used any of the various available methods for controlling error rates; nor were inferences adjusted to reflect concern for multiplicity; indeed, readers were not even warned about the possibility of the problem.

The seriousness of this finding is magnified by the extent to which significance testing is used in managerial accounting research. Table 2 reports the frequency of use of significance tests. A total of 3,082 tests were performed in the 43 articles surveyed. Of these, 1,211 tests were classified as being peripheral or minor to the testing of the study's a priori hypotheses. These peripheral tests consisted of such things as manipulation checks, exploratory tests on relationships not specified a priori, and testing to determine whether the assumptions of the statistical method being used were satisfied. The other 1,871 tests focused directly on examining the status of the a priori hypotheses that motivated the study (called major tests). This translates into an average of 43.5 major tests per article! The distribution is highly skewed, however, so the median of 20 provides a better representation of central tendency. The middle 50% of the articles surveyed ranged from 11 to 64 major tests per article. Note, these statistics are conservative—authors undoubtedly perform more tests than they report!

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[6] Cross-validation is a widely recommended practice that typically uses a random division of a data set into two parts. One part is used to 'fit' the model and the other part is used to 'validate' the model. However, both Hirsch (1991) and Chatfield (1995b) argue that splitting a sample into two parts is a poor substitute for true attempts at replication (see also Mosteller and Tukey, 1977:39).

[7] This survey was part of a much larger methodological study. Survey details are reported in Lindsay (1993a).

As one might suspect, the number of significance tests performed in laboratory and survey studies is substantially different. For the former (11 studies), the mean (median) number of major tests per article is 16 (12), with the middle 50% of the articles ranging from five to 22 tests per study. For surveys (32 studies), the mean (median) number of major tests per article is 53 (31.5), with the middle 50% of the papers ranging from 12 to 77 tests per study.

These findings suggest that a real concern exists for type I error pyramiding, particularly in survey research. Even if the median of 20 tests is used, on average, assuming $\alpha = 0.05$, there will be one false rejection per study (20 x 0.05). This calculation assumes independent tests, which might result in a slightly overstated estimate. However, any potential overstatement is more than compensated for by the following factors: 51% of the studies used α values equal to 0.10; many more tests are undertaken than are actually reported (i.e. the effects of data mining are not considered); and the peripheral tests were ignored. In summary, many more type I errors exist in the management accounting literature than casual reflection might suggest.

Finally, and although the present survey results do not speak to this, the concern for type I error inflation is likely to be as serious in capital market research as it appears to be in management accounting, because data are readily available and the number of explanatory variables and possible model formulations is high (Ball and Foster, 1982).

4. Error rates: issues and philosophy

The preceding discussion suggests that multiplicity is a serious problem that accounting researchers need to consider in making statistical inferences. However, before discussing how to adjust inferences, it is first necessary to examine the statistical controversy associated with determining the appropriate conceptual unit for calculating error rates.

4.1. Basic Issues in Thinking About Error Rates

Little ambiguity exists in interpreting a type I error rate when only one significance test is performed, say based on examining a single pair of group means, or testing a single independent variable in linear regression. However, this changes when multiple tests are performed, implicitly and/or explicitly, because a critical level of significance or 'error rate'[8] can be specified for a number of different conceptual units. Essentially, the decision involves a choice between controlling an error rate for each inference or for some group of inferences (Davis and Gaito, 1984:4; Toothaker, 1993:8). The choice is important because it determines the critical level of significance for each particular test or inference, denoted as α^*, and, consequently, influences the power of the test, as will be explained below.

4.1.1. Per comparison error rate (PCER)

This is the probability that any single test will incorrectly reject the null hypothesis, and is analogous to the conventional definition of a type I error. The PCER is controlled at traditional α levels (e.g. 5%), whereby $\alpha^* = \alpha$. The focus is on controlling the error rate for *each* test that is explicitly performed. Probability pyramiding concerns resulting from multiplicity or selection do not impact on inferences, at least not objectively. This approach is sometimes referred to as the comparisonwise method.

4.1.2. Familywise error rate (FWER)

The FWER is the error rate for a *family* of tests conducted in a study. A family is defined by Hochberg and Tamhane (1987:5) as 'any collection of inferences for which it is meaningful to take into account some combined measure of errors'. Thus a family might relate to a particular treatment, hypothesis or decision. Under this interpretation, the error rate reflects the probability of obtaining one or more erroneous rejections of the null hypothesis in a specific test family. Consequently, this error rate formally admits probability pyramiding concerns into the formal (public) analysis. The basic reasons for considering a set of inferences as a family has been stated by Hochberg and Tamhane (1987:6–7) as follows:

(i) To take into account the selection effect due to data mining; and

(ii) To provide a probability for the simultaneous correctness of a set of inferences to assist in making a correct overall decision.

Considerable controversy exists about which conceptual unit is most appropriate (see Davis and Gaito, 1984; Ryan, 1985b; Hochberg and Tamhane, 1987; Saville, 1990; Kirk, 1995). The crux of the issue underlying the controversy is that the PCER approach does not incorporate the issue of multiplicity, which has been stated by Diaconis (1985:9) as follows: 'If enough different statistics are computed, some of them will be sure to show structure.' Specifically, if the error rate per com-

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[8] To avoid confusion, the term 'error rate' is often substituted for the critical level of significance in multiple comparison situations. This term is due to J. W. Tukey (Ryan, 1959:28–29).

Table 2
Ubiquity of tests of significance in managerial accounting research

A. All studies (n=43)	
Number of MINOR tests (peripheral to testing study's a priori hypotheses)	1211
Number of MAJOR tests (directly involved in testing a priori hypotheses)	1871
Total number of tests	3082
Average (median) number of MAJOR tests per article	43.5(20)
Range for middle 50% of articles (major tests)	11-64
B. Laboratory studies (n=11)	
Average (median) number of MAJOR tests per article	16(12)
Range for middle 50% of articles (major tests)	5-22
C. Survey studies (n=32)	
Average (median) number of MAJOR tests per article	53(31.5)
Range for middle 50% of articles (major tests)	12-77

parison is held constant for each test, the FWER increases rapidly with the number of implicit and/or explicit tests performed. Assuming independent tests, the probability of making one or more type I errors in a group of tests is (Kirk, 1995: 119):

where c is the number of tests conducted.[9] For example, if $\alpha^* = 0.05$ for each of $c = 5$ tests, the FWER is ≤ 0.226.

On the other hand, the increase in error inflation is compensated for by the preservation of statistical power that follows under the PCER approach to error control. Power is an increasing function of α, leading to the classical trade-off between α and β, and therefore power.[10] If the FWER is to be maintained at some desired level, then α^* must progressively decrease as the number of tests increase, resulting in a loss of power and therefore an increased probability that the researcher will miss detecting a valuable finding (unless sample sizes can be increased). For the above example with $c = 5$ inferences, if the family error rate is to be maintained at 0.05, then α^* for each test must be lowered to 0.0102. Table 3 provides the PCER and FWER for various family sizes.

4.2. *Controlling Error Rates*

Essentially then, consideration of the relative importance of type I versus type II errors becomes the crucial issue underlying the error rate controversy (Davis and Gaito, 1984; Berry, 1990; Toothaker, 1993; Kirk, 1995). However, striking the appropriate balance is a subjective decision that lies outside the theory of statistics (Neyman, 1950:262), one that must be left to each investigator to determine in their own particular case (Neyman and Pearson, 1933/1967:146; Fisher, 1959:42).[11] Consequently, neither approach or emphasis is always right and neither is always wrong (Berry, 1990; see also Hochberg and Tamhane, 1987). The specific circumstances in each study need to be considered in achieving the 'corrrect' balance in pursuing what Berry (1990:1,229) calls 'a reasoned approach that recognises the possibility that observed differences may be the result of random variability as well as the possibility that they are real'. Three main types of consideration are relevant in arriving at such a decision.

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[9] In many situations the tests are likely to be correlated with one another; consequently, the FWER should be considered as representing an upper bound estimate. Specifically, if the variables underlying the tests are correlated, the probability of making at least one type I error is between FWER and α^*. If they are perfectly correlated, FWER = α^*. Toothaker (1993:8) states that empirical research reveals that in practice the FWER is fairly close to the result provided by equation 1, even when not all tests are independent.

[10] The statistical power of a test represents the probability of rejecting the null hypothesis when it is false and some specific alternative hypothesis is true. It may be calculated as $(1-\beta)$, where β represents the probability of 'accepting' a false null hypothesis when some specific alternative is true (otherwise known as committing a type II error).

[11] In a book devoted to the study of multiple comparison tests, Miller (1981:31,35) writes: '[Determining the appropriate conceptual unit] is the hardest part of the entire book because it is where statistics takes leave of mathematics and must be guided by subjective judgment....There are no hard-and-fast rules for where the...lines should be drawn, and the statistician must rely on his own judgment for the problem at hand' (emphasis removed).

4.2.1. The nature of the study

The type of study—exploratory or confirmatory—is a critical factor in determining what group of inferences constitutes a single family. Hochberg and Tamhane's (1987) analysis, hereafter H&T, is particularly insightful, and the following discussion draws upon it.

Although most studies combine both confirmatory and exploratory elements, it is useful to discuss them separately. In confirmatory research, the questions of interest or lines of inquiry are stated in advance, whereas in exploratory research they are generated by data mining. On the former, there are a finite number of inferences that are of interest, and these can be specified largely before the data are collected. H&T state that if these inferences are unrelated (although they may be statistically dependent), then each inference or test should be treated as a separate family. Conversely, if an inference depends on the joint correctness of a number of tests, then that collection of inferences should be considered jointly as a single family. In general, for confirmatory (or planned) tests, the family will be relatively small, providing for higher power due to the use of α^* values approaching conventional levels.

Exploratory research is much more complicated. To compensate for selection, H&T indicate that *all* 'potential' inferences should be considered as a single family, consisting not only of those that were actually made but also those that could have been made. Potential inferences are characterised as those that would have been equally plausible from the start; those that would have made the researcher sit up and take notice in a similar way had the results for them appeared favourable (see also Tukey, 1977a:681). By considering all inferences, i.e. even those that were not made, the probability of any error among the selected inferences is automatically controlled at the FWER.

As a generalisation then, reducing α^* to adjust for multiplicity and selection will normally be expected to have serious implications, i.e. a significant reduction in α^*, mainly for those inferences that are exploratory in nature.

4.2.2. Prior knowledge

The above discussion also suggests that inferences within the classical framework need to incorporate prior knowledge—in the spirit of a Bayesian (see Johnstone, 1986:496–497). Experienced classical statisticians have always suggested using some sort of informal weighting system (i.e. judgment) in determining when an unlikely event should be considered as sufficiently convincing for rejecting the null hypothesis. In Fisher's (1959:42) words: 'No scientific worker has a fixed level of significance at which from year to year, and in all circumstances, he rejects hypotheses; he rather gives his mind to each particular case in the light of his evidence and his ideas.' Specifically, researchers should require a greater amount of evidence (i.e. a smaller p-value) for those tests where little a priori knowledge or theory exists to support the finding. Intuitively, possessing a high prior probability for the null makes a person more inclined to attribute an unlikely outcome to chance, resulting in the need for a lower critical level of significance in order to have confidence in the rejection (Hodges and Lehmann, 1964:326, Spielman, 1974:219; Barnett, 1982:11–12). Conversely, as prior knowledge for a finding increases, only modest (conventional) levels of significance are required.

Table 3
Error rates as a function of the number of inferences (c) when equation 1 holds

c	$PCER=\alpha^*$	$FWER$
1	0.05	0.05
3	0.05	0.143
3	0.017	0.05
5	0.05	0.226
5	0.0102	0.05
10	0.05	0.40
10	0.0051	0.05
50	0.05	0.923
50	0.0010	0.05

This point is directly transferable to the multiplicity situation. As Tukey (1991) explains, any report on the unusualness of a single hand of cards would normally be interpreted quite differently if we knew it was the only deal ever made, or one of a thousand deals, or one of a million deals. Consequently, in conducting unplanned tests, it is entirely appropriate to demand a greater degree of evidence against the null to guard against the effects of multiplicity and selection.

With this discussion as background, the issue in the first example discussed at the onset of this paper can now be resolved.[12] Although both investigators attained the same p-value, by virtue of the fact that investigator B only tested a single moderator (intervening) variable suggests that the prior probability for the reported relationship was higher for B than it was for A, supporting the use of a higher α^* to permit rejection of the null. In A's situation, the prior for the reported relationship appears to be lower and the family bigger (consisting of the three moderator variables that were examined), which justifies requiring a lower α^* for each test. In conclusion, different inferences regarding the strength of the rejection are possible, despite the fact that the same p-value was obtained in the two situations.

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[12] In general, Bayesians, while likely being somewhat sympathetic to the explanation that follows, vehemently object to the strict classical position that behoves the researcher to adjust α^* values to account for multiplicity. Their basic point is that the evidence contained in the data, as expressed in the likelihood function, is not affected by the act of testing other relationships (Spiegelhalter and Freedman, 1988; Berry, 1990). The following example provided by O'Brien (1983:788) is particularly convincing: 'It seems ironic that when many investigators publish their separate findings in the medical literature, per-comparison error rates are routinely accepted. However, when one investigator takes on the entire job himself, the same approach may no longer be deemed valid. Rather, he is required to achieve a considerably higher level of significance for each comparison, virtually as a penalty for undertaking such

The incorporation of prior information when making unplanned inferences is not unproblematic, however. As Berry (1988, 1990) notes, in advance of analysing the data, it seems impossible to specify a prior probability for each tendency that might arise. After seeing patterns in the data, assessing one's prior, while possible, is fraught with danger because of the extraordinary capacity for humans to create explanations for even the most outlandish phenomena (see also Good, 1983:139).

4.2.3. Replication

In arguing for the per-comparison error rate using traditional (unadjusted) α levels, Saville (1990) writes that the problem of multiplicity (and selection) in unplanned tests occurs because significance tests are used to *simultaneously generate and test hypotheses*. He suggests that the simple solution is to treat them only as hypothesis generators and to insist on independent confirmation. One can then dispense with the use of complex multiple comparison procedures, including the familywise concept of error, which often result in overly stringent α^* values and, as a consequence, lower power levels.

There is much logic to this suggestion. If a type I error is made, subsequent replications will detect it; whereas no such protection can be said to exist for failing to discover an important relationship. In this way, replication can be said to provide a reprieve for the researcher who is faced with the dilemma of balancing type I and II errors (Davis and Gaito, 1984). What becomes important is for researchers to accurately describe the selection process that led to the reported results, rather than pretending that the reported relationships fell upon them like 'manna from heaven' (Selvin and Stuart, 1966; see also Flueck, 1979; Lovell, 1983; Hochberg and Tamhane, 1987). Otherwise, the results convey a greater sense of conclusiveness than is warranted.

Unfortunately, two powerful traditions work against the replication reprieve. The first is that few studies get replicated in accounting (Abdolmohammadi et al., 1985; Burgstahler and Sundem, 1989:90; Hubbard and Vetter, 1996). The second is that, if replication is to serve its confirmation role, well-performed studies reporting non-significance or 'negative' results need to be published. However, a bias exists in the publication system against publishing negative result studies (Lindsay, 1994; Sterling et al., 1995). In addition, there is another consideration that counters the force of Saville's replication argument. This involves the thorny issue of whether journal editors should publish exploratory results. Many people look at journals as a resting place for facts, not speculation (e.g. Ryan, 1985a). However, if editors do not publish exploratory results, researchers are provided with a strong temptation to cheat, i.e. not to honestly report the full extent of the selection process, and this is a situation that is impossible to detect (Berry, 1988).

5. Methods for controlling and balancing α and β

The discussion now turns to illustrating two statistical approaches that can provide an effective strategy for balancing α and β in a manner consistent with the investigation's objectives. The reader should be warned that the area of multiple comparison procedures is a confusing area of statistics, one that receives widely differing recommendations from statisticians. The reader is referred to Games (1971b), Davis and Gaito (1984), Toothaker (1993) and Kirk (1995) for expositions of the various methods available. The methods selected for illustration were chosen because of their simplicity, general applicability, and potential usefulness to accounting researchers. In addition, they are well established in the statistical literature.

5.1. The Bonferroni Method

5.1.1. The unweighted Bonferroni method

Both Rosenthal and Rubin (1984) and Kirk (1995) describe the Bonferroni method as being characterised by intuitive appeal, computational simplicity, and, in many cases, preserving a surprising amount of power for a generally conservative procedure. In addition, the system is so general that it can be employed with tests that are entirely orthogonal, entirely non-orthogonal, or mixed: it can be based on any significance test, e.g. F, χ^2 and t, and used with equal or unequal numbers of observations per condition. It also has the added advantage of being capable of establishing

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an extensive effort.' Although remaining within the confines of a classical statistics framework, this paper has attempted to incorporate these concerns by the particular definition adopted for determining the constitution of a 'family' of tests and by admitting, if only crudely, prior beliefs in determining α^* values.

simultaneous confidence intervals for a number of inferences.

The procedure is based on the use of the t distribution, and incorporates the number of inferences (c) that are planned. In a data mining situation, c would need to be calculated on the basis of all potential inferences that are possible, as discussed earlier. The essence of the method is to reduce the critical level of significance for each test (α^*), so that the familywise error rate (FWER) remains at some acceptable level. By rearrangement of equation (1) presented earlier, α^* can be determined to place an upper bound on FWER for any set of c inferences:

$$\alpha^* = 1 - (1 - \text{FWER})^{1/c} \tag{2}$$

A simpler computation yielding approximately the same results (particularly for small c) is:

$$\alpha^* = \text{FWER}/c \tag{3}$$

In both cases (equations (2) or (3)), the null hypothesis for a particular test is rejected if the observed probability is $\leq \alpha^*$.[13]

Illustration. Suppose an experimenter has four comparisons to test, and establishes the FWER at the 0.05 level. Based on equation (3), the nominal level of significance for each test is set at $\alpha^* =$ 0.0125 (i.e. 0.05/4). If the obtained p-values are 0.005, 0.015, 0.03, and 0.02, the researcher will only be able to reject the null hypothesis for the first comparison.

5.1.2. *The weighted Bonferroni method*

The basic problem with the unweighted procedure is that as the number of tests increase, the power of each test decreases. However, the method's flexibility provides some redress to this situation through the incorporation of prior knowledge and/or the importance of tests. Providing that tests can be ranked *before* they are performed (and this is crucial), power can be conserved for the more important inferences and sacrificed for the less important by raising and lowering individual α^* values to maintain the FWER at some desired level. Following Rosenthal and Rubin (1984), the procedure is based on assigning a weight, which may include zero, to each test in direct proportion to its prior probability and/or a priori importance. If W_j is the weight indicating the importance of the jth test, and ΣW is the sum of the weights over all c tests, then based on equation (3) the critical level of significance for the jth test is:

$$\alpha_j^* = \frac{FWER\ W_j}{\Sigma W} \tag{4}$$

Illustration. Suppose the ranking of the previously examined tests is represented by the weights (W_j) 10, 8, 5 and 2. Based on equation (4), the respective α_j^* values would be 0.02, 0.016, 0.01 and 0.004 (e.g. 0.05(10)/25 = 0.02 for the first test). In this situation, the null can only be rejected for the first two tests based on the obtained probability values reported in the prior illustration.

Although good reporting practice suggests that test statistics and p-values should always be reported, this becomes essential when weighted Bonferroni methods are used, so that readers possessing a different set of weights can derive their own conclusions (de Cani, 1984).

5.1.3. *Applicability of Bonferroni concepts to regression*

The Bonferroni method can be used in regression analyses, either for constructing a family of confidence intervals for regression coefficients, or for performing hypothesis tests on individual coefficients. Neter et al. (1989) provide examples of each. In addition, in discussing type I error inflation in stepwise regression analysis, Draper and Smith (1981) suggest using equation (1) to provide a rough guide for determining 'actual' α values for a family of tests.[14] Equations (2) or (3) could then be used for controlling the FWER at some specified level.

Finally, the Bonferroni inequalities can be used in the situation where an investigator wishes to build a model using the best k out of c candidate explanatory variables. Lovell (1983) provides the following rule of thumb for calculating 'actual' significance levels for those regression coefficients declared significant at nominal levels of significance (α^*):

$$\alpha = 1 - (1 - \alpha^*)^{c/k} \tag{5}$$

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[13] The procedure following equation (3) is often referred to as the Dunn multiple comparison procedure, while the one in equation (2) is typically called the Dunn-Šidák multiple comparison test (see Kirk, 1995). The Dunn-Šidák version is slightly more powerful (Kirk, 1995). Critical t values for the procedures are provided in Dayton and Schafer (1973) and Kirk (1995).

[14] Recall that equation (1) assumes independent tests, which is an assumption that is often violated in practice. Consequently, estimates should only be considered as representing rough guides.

A simpler calculation that yields similar results is:

$$\alpha = \frac{c}{k}\alpha^* \tag{6}$$

The FWER for the k tests is then determined by the equation

$$\text{FWER} = 1 - (1-\alpha)^k \tag{7}$$

with α representing the 'actual' significance level for the k tests as determined by equations (5) or (6). This result reconciles to the FWER produced by equation (1), based on c tests at claimed level of significance α^*. To control the level of significance for each test at some specified level α, α^* must be reduced as follows based on equations (5) and (6) respectively:

$$\alpha^* = 1 - (1-\alpha)^{k/c} \tag{8}$$

$$\alpha^* = \frac{k}{c}\alpha \tag{9}$$

For example, assume an investigator wishes to include $k = 2$ explanatory variables in the final regression model out of a possible $c = 10$ candidate variables using a nominal critical level of significance for each test of $\alpha^* = 0.05$. By equation (1), the FWER is 0.401. In other words, there is only a probability of 0.599 that no significant differences will be reported when the overall null is true, i.e. H_0: $\beta_1 = \beta_2 = \ldots = \beta_{10} = 0$. This is equivalent to a valid t-test at the $\alpha = 0.226$ level for testing the two best variables (equation (5)). To adopt a 'true' significance level of $\alpha = 0.05$ for each test, α^* would need to decrease to 0.0102 (equation (8)). Testing the two best variables at the $\alpha^* = 0.0102$ level then produces a FWER of 0.0975 by equation (7), i.e. $1-(1-0.05)^2$, which is equivalent to the FWER if all 10 variables were tested at the $\alpha^* = 0.0102$ level of significance.

This discussion also serves to illustrate how the researcher pays a price for admitting more variables into the testing pool. Searching for the best two out of 10 candidate variables at the 0.01 level produces the same FWER as testing two variables specified in advance at the 0.05 level.

5.2. Cohen and Cohen's Adaptation of Fisher's Protected t Method

Multiple regression is widely used by accounting researchers for both testing and building models. Consequently, an approach specifically tailored to this application should be of considerable interest and benefit to them. In this regard, the method described by Cohen and Cohen (1983:169–176) in their book *Applied Multiple Regression/Correlation Analysis for the Behavioural Sciences* appears particularly helpful. The major elements of Cohen and Cohen's (hereinafter C&C) approach consist of parsimony in the number of variables employed, the use of Fisher's protected t test method, and a hierarchical ordering strategy to provide for a priority weighting scheme for variables of differing plausibility and/or relevance. The middle element will be modified to incorporate a superior method that has appeared in the statistical literature since the writing of C&C's book. Each element will be considered in turn.

5.2.1. Parsimony in variable employment

Researchers should include as few criterion (dependent) or predictor (independent) variables as possible, while keeping within the goals of their investigations. The motivation for this guideline stems from a concern for statistical power brought about by the fact that, all too frequently, researchers in the 'soft' (behavioural) research areas and/or those pursuing exploratory studies include more rather than fewer variables in the hope of finding some as yet undiscovered relationship of importance.

C&C's concern for the lack of statistical power is based on three points (pp. 161–171). First, α^* values for each test must decrease as the number of tests increase to maintain the familywise error rate at some desired level, thus reducing the power of tests of individual regression coefficients. Second, the power of a test decreases as k, the number of predictor variables (PVs), increases. This occurs in two ways. One is that for any given n, the degrees of freedom in the error term $(n-k-1)$ diminish as k increases. The other stems from the fact that statistical power in multiple regression analysis is a function of three parameters: the population effect size (which represents the proportion of Y variance accounted for by the PV(s) in question relative to the proportion of error variance), α and k. For a given effect size and α, power will decrease as k increases. Finally, multicollinearity among the predictor variables is magnified as k increases. This reduces a test's power because multicollinearity manifests itself in producing larger coefficient standard errors, and therefore smaller t statistics.

Taken together, C&C's recommendation—'less is more'—provides sound advice. As C&C state: 'Having more variables when fewer are possible increases the risk of finding things that are not there and failing to find things that are' (p. 170).

5.2.2. The Fisher-Hayter test

C&C recommend the use of Fisher's protected t test method for significance testing. However, most statistical authorities no longer recommend its use (Toothaker, 1993:42; Kirk, 1995:123); consequently, a modification that overcomes their concerns, due to Hayter (1986), is proposed as a substitute. The Fisher-Hayter test consists of two steps. The first step involves performing an overall F test on the composite hypothesis that all regression coefficients equal zero. If this test fails to attain statistical significance, no further tests are permitted and the researcher fails to reject the null for all variables. If the overall F test attains statistical significance, the second step is performed, whereby individual PVs are tested for their incremental contribution to Y's explained variance using a critical t rejection value (t_c) that is based on the Studentized range distribution (q) with input values α (familywise error rate), $k-1$ (to reflect the two step procedure), and $n-k$ degrees of freedom (Toothaker, 1993:43):

$$t_c = \frac{q_{\alpha,\, k-1,\, df\, n-k}}{\sqrt{2}} \tag{10}$$

For example, assume the regression model includes $k = 4$ predictor variables and the sample size n is 64. An F test rejects the overall null at the 0.05 level of significance. This allows the researcher to pursue the second stage, whereby each PV is tested using a critical t value of 2.4 (3.4/√2). The FWER is then controlled at the 0.05 level.[15]

Continuing with the above example, while the power of the Fisher-Hayter method is less than it is for the traditional t test (which would require a critical t value of only 2), the FWER for the traditional test is 0.185 (by equation (1)) as compared to only 0.05 for the Fisher-Hayter approach. The Fisher-Hayter method therefore provides an excellent trade-off between the need to preserve power and the need to control familywise error rates. Nonetheless, if power is considered to be too low, an option is to increase the FWER to $\alpha = 0.10$, resulting in a critical t value of 2.09.[16] This is close to the value of underlying the traditional t test (i.e. power levels are similar), while providing considerable more control over the FWER.

It should be noted that the Fisher-Hayter method does suffer from the weakness that it cannot be used to calculate confidence intervals because it is a two-step procedure. The Bonferroni method should be used if confidence intervals are desired. In addition, a comparison of critical t values for the Fisher-Hayter and Bonferroni methods should always be performed before conducting any tests (see Toothaker, 1993:46). The Bonferroni method might provide for higher power (i.e. a lower t_c) if the researcher is only interested in testing a subset of the predictors in the model, e.g. when some PVs are included for statistical control purposes only.

5.2.3. A hierarchical ordering strategy

An investigator often gathers data on a number of exploratory variables in addition to the PVs underlying the primary focus of the research. In these circumstances, C&C suggest grouping the PVs (or sets of PVs) into heriarchies, ordered with regard to their research relevance or priority. The logic behind this recommendation is that hierarchical orderings prevent PVs of lower priority, which are likely to account uniquely for little variance in Y, from reducing the power of the tests from those PVs of higher priority by stealing some of their variance,[17] increasing the standard errors of their partial coefficients (i.e. the multicollinearity problem), and reducing the degrees of freedom in the error term (p. 171).

C&C require that each PV (or set of PVs) be entered and tested cumulatively in a specified hierarchical ordering. On the addition of each new PV (or set of PVs), the incremental variance accounted for by the PV (or set of PVs) is put to the overall F test. For example, suppose two groups (A and B), each consisting of $k_A = k_B = 4$ variables, make up the total analysis. The first part of the analysis would consist of performing an overall F test on the variables in set A, based on the following formula (C&C:104):

$$F = \frac{(R^2_{Y.A})\,(n-k_A-1)}{(1-R^2_{Y.A})\,k_A} \tag{11}$$

with degrees of freedom k_A (numerator) and $n-k_A-1$ (denominator), and where $R^2_{Y.A}$ represents the percentage of variance in Y explained by the variables in set A. *If and only if* F is statistically significant may testing individual PVs be performed using the Fisher-Hayter method. Follow-

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[15] See footnote 4 for references providing tables for critical values of the Studentized range distribution (q) that are used in the numerator of equation (10). Note, too, that the Fisher-Hayter method is a candidate for use when examining group means (as discussed in Section 2.1). Specifically, a one-way ANOVA could be used in the first step to test the hypothesis that a set of group means are all the same. Individual pairwise comparisons would then proceed if the overall test was significant.

[16] See Lindsay (1993a) for a discussion on determining a sensible balance between α and β.

[17] Testing the statistical significance of any regression coefficient associated with a PV is tantamount to testing the increment in the proportion of variance that the predictor accounts for in Y (i.e. a variable's semi-partial r^2) when it is entered last into the regression equation (Pedhazur, 1982:123).

Table 4
Lau et al.'s (1995:371) results of a regression of managerial performance (Y) on budgetary participation, budget emphasis and task difficulty

		Model 1		*Model 2*		*Model 3*	
		(Main effects)		*(Two-way)*		*(Three-way)*	
variable	*Coefficient*	*Est.*	*Prob.*	*Est.*	*Prob.*	*Est.*	*Prob.*
Constant	b_0	5.795	0.000	5.770	0.000	5.759	0.000
Budget participation (P)	b_1	−0.028	0.006	−0.032	0.002	−0.037	0.001
Budget emphasis (B)	b_2	−0.114	0.002	−0.123	0.002	−0.108	0.006
Task difficulty (T)	b_3	0.035	0.021	0.031	0.039	0.016	0.311
PXB	b_4			0.003	0.306	0.004	0.155
PXT	b_5			0.005	0.032	0.006	0.026
BXT	b_6			−0.004	0.630	−0.011	0.223
PXBXT	b_7					0.002	0.032
R^2		0.268		0.314		0.344	
F value			13.2		8.0		7.8
$p<$		0.001		0.001		0.001	

ing this, the incremental variance in Y accounted for by the variables in set B is put to an overall F test using the following formula (C&C:146):

$$F=\frac{R^2_{Y.AB}-R^2_{Y.A}}{1-R^2_{Y.AB}}\times\frac{n-k_A-k_B-1}{k_B} \quad (12)$$

with degrees of freedom k_B and n-k_A-k_B-1. If the overall F test proves to be statistically significant, the investigator may then go on to perform individual tests on the PVs making up set B, using the Fisher-Hayter method.

5.2.4. An application of C&C's method in accounting research

C&C's hierarchical approach does not appear to be used to any great extent in accounting. Yet it is particularly well suited to research in managerial accounting examining the Hopwood/Otley conflict regarding supervisory evaluative styles, an area of research that Brownell and Dunk (1991:703) view as the only organised critical mass of empirical work in management accounting. Much of the recent research in this area involves the testing of two and three-way interaction effects (e.g. Brownell and Hirst, 1986; Brownell and Dunk, 1991; Gul et al., 1995). In the typical study, the researcher only tests for the statistical significance of the interaction variable, without any consideration of its explanatory power, i.e. size of effect. This represents poor practice because statistical significance is ancillary to parameter estimation (Lindsay, 1995). In addition to controlling the FWER, C&C's method based on the use of hierarchical analysis allows researchers to determine the additional explanatory power of the interaction variable over and above the main effect variables. This information is helpful in determining whether the current emphasis on examining interaction variables and thereby pursuing finer contingency relationships is fruitful.

The study by Lau et al. (1995) provides sufficient information to use as an illustration of C&C's hierarchical approach. One of their hypotheses examined whether a statistically significant three-way interaction among budget emphasis, budgetary participation and task difficulty affecting managerial performance (Y) exists. The analysis consisted of examining three models: main effects only; main effects and two-way interactions; and main effects, two-way and three-way interactions. The results of the analysis are reproduced in Table 4.

The overall F test for the first (main effects only) model is statistically significant (see Table 4), thereby permitting the three predictor variables to be tested for statistical significance. Based on equation (10), the critical value for the t statistic is calculated as follows (based on α = 0.05, k = 3, and n = 112):

$$t_c=\frac{q_{\alpha=0.05,\,k=3-1,\,df\,112-3}}{\sqrt{2}} = 1.984$$

While the individual t statistics are not reported by the authors, it is clear from examining the p-values that they would all be statistically significant. The FWER for this set of variables is therefore controlled at α = 0.05.

Turning to the second model, the *incremental* variance in Y accounted for by the variables in model 2 is put to an overall F test as follows (based on using equation 12, where n = 112, k_A = 3, k_B = 3):

$$F=\frac{(0.314-0.268)}{(1-0.314)}\times\frac{(112-3-3-1)}{3}=2.347$$

This value is not statistically significant at the 0.05 level because the critical $F_{\alpha=0.05,3,105}$ value is 2.7. Consequently, tests of the individual two-way interaction terms would not be permitted under the Fisher-Hayter method (assuming the researcher had an interest in doing so). In particular, the low p-value associated with the b_5 coefficient (P x T) in the second model is of no consequence.

Finally, putting the incremental variance accounted for by the three-way interaction term to an F test (with n = 112, k_A = 6, k_B = 1) results in

$$F=\frac{(0.344-0.314)}{(1-0.344)}\times\frac{(112-6-1-1)}{1}=4.756$$

which is statistically significant at the 0.05 level. However, what is interesting to note about this finding is that although the three-way interaction term is statistically significant, its semi-partial r^2 of 3% pales in comparison to the 26.8% accounted for by the main effect variables, a point that was duly noted by the study's authors.

In conclusion, the hierarchical testing approach, together with the Fisher-Hayter method, is extremely effective in controlling a study's overall type I error rate. The overall type I error rate in the above example is in the vicinity of 0.14 ($1-0.95^3$) for the three sets (models) examined. This contrasts favourably with an error rate of approximately 0.3 if the usual t-test method had been performed ($1-0.95^7$).

6. Conclusion

This article concludes with a number of points that are worthy of emphasis. First, it is important to appreciate the fact that unusual events usually happen (see Kruskal, 1979). A fundamental tenet of applied statistics is that because so many possibilities exist, most data sets are unusual in some unexpected regard (Berry, 1988). This is why statisticians constantly emphasise that 'significant' relationships detected from using unplanned tests should not be used as a basis for any *conclusion* unless there is a priori knowledge of their relevance *and* subsequent validation by other independent data sets (Flack and Chang, 1987).

Second, the rigid use of pre-assigned error rates is not being advocated in this article. Error rates should only be used as guides, and are conveniently considered as fixed for the purpose of making power calculations (see O'Neill and Wetherill, 1971). In making inferences, researchers must incorporate their a priori knowledge about the relationship at hand (which could conceivably change after seeing the data and all the various obtained patterns), along with a consideration of the total number of tests (implicit and explicit) that have been performed. This is a departure from the strict classical (frequentist) approach, but one that many statisticians support.

Third, given the dominant emphasis that researchers place on controlling type I errors—often to the total neglect of power (see Lindsay, 1993a)—it is important to reiterate that the choice of levels for the FWER and α^* must be made in conjunction with a consideration for statistical power. As Games (1971a) notes, little justification exists for using sophisticated attempts to control type I errors when little or no attempt is made to control type II errors (see also Davis and Gaito, 1984).

Fourth, behavioural research suffers from many studies being conducted with far too little power (Sedlmeier and Gigerenzer, 1989; Lindsay, 1993a). This situation, along with the fact that many significance tests are often performed in a single study, suggest that individual α^* values and FWER error rates will have to rise well above conventional levels if anywhere near reasonable power levels are to be attained. Indeed, these considerations would seem to question the meaningfulness of running significance tests for this class of studies. At the very least, they underscore the importance of Cohen and Cohen's (1983) conclusion that 'less is more' (see also Cohen, 1990).

Fifth, it is all too likely that the preceding discussion, associating exploratory inquiry and significance tests in the same breath, has added to the prevalent viewpoint that sees the totality of statistics as reflecting significance *testing* procedures (see Salsburg, 1985; Nelder, 1986; Kruskal and Majors, 1989). However, this viewpoint is patently false, and the reader is referred to Tukey (1977b), Diaconis (1985), Cohen (1994) and Lindsay (1995) for a discussion of this matter.

Finally, it needs to be emphasised that the methods and guidelines identified in this paper do *not* solve the problem of multiplicity and selection; at best, they only serve to provide a framework for attempting to cope with the problem; and even this requires researchers to report the actual selection process underlying results reported as statistically significant so that readers can make informed inferences. To what extent such reporting occurs—given the various traditions which serve collectively to counteract this requirement, e.g. publish or perish, the difficulty in publishing exploratory results, the negative result bias, and the fact that journal space is at a premium—is impossible to determine.

In conclusion, the only way to solve the multiplicity problem is to replicate results on fresh data (Diaconis, 1985:18). Isolated statistically significant results should only be considered as being *suggestive*, and not definitive. *Many* studies are required in the process of drawing robust conclusions. This is a conclusion that has been arrived at earlier from a variety of statistical, methodological and philosophical viewpoints (see Lindsay, 1993b, 1994, 1995; and Lindsay and Ehrenberg, 1993). The multiplicity problem simply serves to bolster the overall argument.

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Book Reviews

Business Research: A Practical Guide for Undergraduate and Postgraduate Students. *Jill Hussey and Roger Hussey*. Macmillan, 1997, 357 pp. Hardback £40; paperback £12.99.

As suggested in the title of this book, Jill and Roger Hussey aimed to produce a *practical* guide to business research for both undergraduate and postgraduate students. In addition, the authors state that they wished to set out this practical guide simply and clearly, and in a logical sequence. It can be said immediately that they have achieved these objectives. The emphasis throughout is very practical, in the 'how-to-do-it' sense. Checklists and bullet points abound to guide the student and help to ensure that no practical consideration relating to commencing, conducting and completing a research project, dissertation or thesis is ignored.

A good attempt has been made to be comprehensive. The book begins by outlining the qualities of a good researcher and then considers issues such as choosing an institution in which to undertake the research, funding needs and sources, negotiating access for research, types of research paradigms and methodologies, literature searching, supervisor relationships, research design, data collection, the analysis of both quantitative and qualitative data, writing up the project and approach to the viva. The book also provides a final chapter, entitled 'Trouble shooting', which specifies 11 problems the student may meet (e.g. how to get started, what methodology to select, is the standard of research good enough) and directs the reader to specific sections of the book to help him or her address their problem.

The book claims to be for the undergraduate or postgraduate student, but, in my view, most of the practical advice applies more to postgraduate researchers. The book is also advocated as a course text, but I would find it difficult to base a course for research students mainly on this book. Because it tries to be so comprehensive, covering both practical advice on so many issues, research paradigms, methodologies, methods of analysing different types of data, etc., it cannot deal with any of the topics normally incorporated into postgraduate research methodology courses in sufficient depth.

Obviously, course texts can be supplemented with readings, but this book's value lies more in its down-to-earth advice on personal and practical issues involved in managing oneself through a research process, rather than its structure for a postgraduate or undergraduate research methodology course. It would be more useful to use the book as something that prospective research students should read, prior to undertaking research, to get a broad overview of the process to which they are subjecting themselves.

It might be valuable to use such an overview to start off a course for postgraduate researchers and help to create, in a couple of three-hour sessions, a generally unified sense of expectations between the student and the supervisor about research, and then explain to students that they have in this book an *outline guide* to issues that will subsequently arise to which they can refer before probing the core issues of development of the research question(s), methodology, data analysis and so on in more depth.

The fact that significantly more depth will be needed is apparent, for example, in the chapter on analysing quantitative data, where a range of elementary statistical routines, including Pearson's and Spearman's correlation coefficients, are described, but where there is no reference to multiple regression. One would not expect a full treatise on multiple regression in a book like this. Nevertheless, given that it was decided to include a chapter on quantitative analysis, and given also the book's attempt to provide practical hints and warnings, it would have been relatively straightforward to have described the outline of multiple regression and the pitfalls in its use of which the student should beware. After all, regression analysis is one of the most widely-used statistical routines in business research.

Similarly, as I am sure the authors would agree, the chapter on qualitative analysis could not be relied on as sufficient for a research student. With the book's focus on practical issues, it would have been no less worthy if it had merely referenced the material on data analysis in Chapters 7 and 8 or, perhaps, excluded the more technical parts of this material and had just one chapter that debated, in a broader and more practical way, data analysis issues.

In summary, the authors have produced a valuable book that I would, at least, tell my research students to read at the outset of their research registration. A discussion with them on various aspects of the book would seem to serve as a good way to begin a supervisor/student relationship. But while I *will* try that out, I still have the feeling that many of the issues raised should not prove significant problems to the capable research student, at least not after some discussion with the supervisor—though I do recognise them as occurring over the many years that I have supervised research students.

Moreover, I have some lurking feeling of uneasiness with the book's tendency to describe research as a routine *work-process* with a largely linear series of steps. Good research requires some flair, imagination, creativity of thought and confidence to question, in a more than marginal way, the current state of knowledge and ways of acquiring it. It also requires looping back and jumping sideways to re-question various steps and literature addressed earlier in the research. Some of my best PhD students over the last 20 years have really been interested deeply in the research subject per se, and in the process of making enquiries relating to it from which a thesis was eventually assembled from various facets of the work. (This would only apply to a minority of the students that I have supervised, but, if my memory does not fail me, Roger Hussey himself would fall into this category! But that was a long time ago.)

I am not suggesting that this is suitable for all students, and I also do recognise that successful research also needs perseverance, systematic enquiry, personal management and, at times, drudgery. The answer must be to seek a blend of these different dimensions that suits each student and her/his research topic. There should not be one universally applicable model; this also shows research supervision to be an art as well as a science. We do need to ensure that our students acquire research skills so that they can claim, with validity, to be professional researchers, but there is also a danger in over-emphasising 'what needs to be done', that the main output of the research process becomes the M.Phil. or PhD qualification in itself, rather than the search for new knowledge.

There is also a danger in trying to over-simplify the research process to the point where it becomes routine. I am not suggesting that the authors have gone that far, but when Jill and Roger come to produce the next edition of their book, they might consider including a chapter that addresses, in the practical style they espouse, how one combines the necessity to see research as a work-process in itself with the need, for part of the research process, to develop creative insights and pursue lines of enquiry in a non-routine manner. Unless, of course, both they (and the readers) think I am wrong.

University of Bath Cyril Tomkins

What's the Story? Arthur Andersen/Binder Hamlyn, London, September 1996. 21 pp. **Operating and Financial Review: Experiences and Exploration.** *P. Weetman and W. Collins.* Research Committee of the Institute of Chartered Accountants of Scotland, Glasgow, 1996. v + 71 pp. £12.50.

The operating and financial review (OFR) represents a major innovation in UK financial reporting. It provides a narrative explanation of corporate financial performance. The OFR was introduced in July 1993 by the Accounting Standards Board (ASB) as a voluntary statement of best practice. Not only does the OFR represent the first major interest by the ASB in the qualitative, rather than the quantitative, aspects of the corporate annual report, but it also signals the ASB's concern with information disclosure outside the traditional, audited financial statements. In short, the OFR attempts to persuade companies to discuss and analyse the operating and financial aspects of a business in a comprehensive, frank and understandable way.

There has been little research into the role, nature and extent of accounting narratives, including the OFR. This is surprising given their importance in the modern annual report. The publication of two reports in 1996 on the role of the OFR is thus to be welcomed. The Arthur Andersen publication and an Institute of Chartered Accountants of Scotland (ICAS) research report by Weetman and Collins are in many ways complementary.

The Andersen report is an empirical survey of 100 listed public companies stratified into three categories by market capitalisation (sampled from top 350 ranked companies, from companies ranked from 351–1,050, and from 700 companies ranking from 1,051). Eleven bar charts summarise the main findings and an appendix provides a good overview of the main features of the OFR. The ICAS research report comprises interviews with 14 companies and an empirical survey of the top FTSE-100 companies, which assesses how well they complied with 'the spirit' of the OFR. The present survey follows up a previous one, published in 1995.

The great advantage of the Andersen report is its punchy presentation. The authors obviously found the prominence given to accounting narratives unexpected: 'What surprised us was that the "narrative" pages exceeded or equalled the number in the statutory financial statements in half of our survey companies' annual reports' (p.5). This was particularly true in the top 350 sample. Turning more specifically to the OFR, Andersen finds that 'while only 10% of survey companies presented a formal operating and financial review, [a further] 36% had clearly adopted the spirit of the OFR recommendations...under a variety of headings and guises' (p.6).

On the specific details encouraged by the ASB statement, Andersen's findings will be disappointing, if perhaps not unexpected to policy-makers.

Ratios, clear identification of trends, clear identification of principal risks and uncertainties, investment for the future, and specific numbers were all notable by their absence.

Andersen's report is a mine of information for those, including policy-makers, who wish to evaluate the success of the OFR. It is interesting and well presented—my only slight quibble is that at times the discussion and analysis is too brief—a particular irony, as the whole purpose of the OFR is discussion and analysis!

The Scottish research report is, by contrast, extremely discursive. Its main strength is the insight that it gives into the preparers' motivations. The best OFRs are found to be based on teamwork and self-monitoring (benchmarking against the OFRs of other FTSE-100 companies). A particularly interesting insight into the corporate world is given by one interviewee, who stated that the OFR's text was constrained by the parallel preparation of the US equivalent document, the management discussion and analysis (MD&A). The US 'lawyers insist that every statement in the MD&A is verifiable by evidence' (p.56). The ICAS report confirms much of the Andersen report's detail. Little constructive use of ratios was found, and companies were reluctant to give specific forward-looking information (about trends and investments) through fears about confidentiality.

In the survey of the top FTSE-100 companies, the report graded companies (A highest—E lowest) in compliance with the spirit of the ASB's proposals (21 being A; 26, B; 28, C; 23, D; and 2, E). There is a marked improvement over a previous survey. In the ICAS survey, 75% of companies comply with 'the spirit' of the OFR. By contrast, using slightly different measurement criteria, 46% of the Andersen survey met 'the spirit'.

Although providing a worthwhile discussion of managerial motivation, the ICAS report could have been enhanced usefully for the academic reader in two respects. First, by the provision of some background on the OFR, and by the contextualisation of the research. There is, for example, a curious lack of references for a research report—only four (with three being to the present authors and with no formal reference to the OFR). Second, more specific detail rather than general discussion would have added authority. For example, the data collection checklist in Appendix B covers 29 specific items. However, apart from the fact that 59% of OFRs used ratio analysis, I was unable to find any specific quantification of the occurrence of other items.

In sum, the Andersen report is strong on context, numerical and quantitative information, but at times needs more discussion. By contrast, the ICAS research report needs more context and detail, but its strength is insightful discussion. Both therefore have partially compensating strengths and weaknesses. Together, they make a useful contribution to our knowledge and understanding of the OFR.

Cardiff Business School Michael John Jones

Clean Surplus: A Link Between Accounting and Finance. *Richard P. Brief and K.V. Peasnell (eds.).* Garland Publishing, New York and London, 1996. xxxvii + 291 pp. ISBN 0-8153-2251-8.

This book provides a collection of readings (most of which have been published previously elsewhere) on the clean surplus relationship, ranging from the historical to the current. Because of the debate over the recommendations of the SFAS 3, it is most timely in reminding us of the issues, both historical and current, underlying this debate. The book is split into four sections: historical perspective; analytical properties of clean surplus equation; the theory of the clean surplus equation; and implications for empirical research. The third section is of particular interest because it publishes an early (January 1989) version of James Ohlson's paper 'Accounting earnings, book value and dividends: the theory of the clean surplus equation (Part I)', subsequently published in *Contemporary Accounting Research* in a much amended form, but which, in its earlier forms, had a substantial impact on empirical financial accounting research.

The first section of the book, on historical perspective, contains pieces on the subject of clean surplus accounting from, amongst others, such esteemed writers as Dicksee, Littleton, May and Paton, together with a previously unpublished summary of the contemporary situation from Eamonn Walsh. The main issues raised in these papers are twofold. First, what is the predictive value of (components of) income? As Dick Brief and Ken Peasnell point out in their introduction to the book, the notion of predictive value is not formally specified in these arguments, however. Nonetheless, arguments that proceed along large intuitive grounds argue for 'dirty surplus' definitions of income that, effectively, remove elements thought to have no predictive power (for example, non-recurring items) from earnings. A second point raised in this section is that, unless clean surplus accounting holds, the total income over some time horizon will not be equal to the sum of earnings recognised during each period within the horizon. Related to this issue is that clean surplus accounting allows the lifetime total income of the firm to equal its total lifetime net cash flows.

The second section, analytical properties of the clean surplus equation, covers material that many might be fairly familiar with by now. In particular, it provides various contributions from such as Edgar Edwards and Philip Bell, John Kay, Dick Brief (with a co-author) and Ken Peasnell themselves that deal with the fairly well-known results that (i) the (present) value of a firm can be represented as the sum of its book value and the present value of expected periodic residual income; and (ii) a suitable weighting scheme can be applied to a series of accounting rates of return such that the weighted average of the series is equal to the internal rate of return.

For me, there are two particular curiosities in this section. First, it publishes for the first time a 1984 paper by Julian Franks and Stuart Hodges on the subject that was quite well known at the time. Second, the initial paper in the section shows that Gabriel Preinreich understood the relationship between present value, book value and residual income in the 1930s. It is humbling to realise, first, how often the wheel is rediscovered and, second, how much Preinreich had discovered over 60 years ago on issues that scholars are still working on currently (often, I believe, in ignorance of his work). Certainly, such a criticism has applied to me. Because of this, Dick Brief's edited book in this series (*A Landmark in Accounting Theory: the Work of Gabriel A.D. Preinreich,* Garland Publishing, London and New York, 1996) should be interesting (reviewed in the Autumn 1996 issue of this journal by Mark Tippett).

The third section contains just one paper—Ohlson's arguably seminal work on linear information dynamics and the clean surplus relationship. Having seen this paper presented at the University of Strathclyde by Jim Ohlson at a seminar organised by Peter Pope, I can well remember the excitement it caused. Given the changes that occurred to it later, it is good to see an early version which stresses an intended contribution relating to accounting theory. Further, and in the context of the book's previous sections, this paper is interesting because linear information dynamics gives a very specific meaning to the idea of predictive value. In addition, linear information dynamics pretty much implies that value can be expressed as a linear combination of the elements of the system, leading to a very tractable analysis.

Nonetheless, the juxtaposition of this paper with earlier ones in the book raises issues about the completeness of Ohlson's analysis. Specifically, in his analysis there is only one element of the system that can be called earnings. Ohlson's contribution is to discover circumstances (for example, dividend irrelevancy holds) where this element can be equated to the sum of dividends and the change in book value. Value then becomes a linear combination of book value, clean surplus earnings and dividends. Nonetheless, by not modelling *components* of earnings, we are not given an answer to whether some components can be valuation-irrelevant in the sense that their weight in the linear combination is zero and, if so, when and why. Under such circumstances, clean surplus earnings are not fundamentally valuation-relevant per se. The same conclusion also applies if the weights attached to different components of clean surplus earnings are different.

The final section of the book, implications for empirical research, contains three papers (by Stephen Penman, John O'Hanlon and the late Vic Bernard) which, while clearly inspired by Ohlson's work, are, nonetheless, related as much to the earlier work described in the section on analytical properties of the clean surplus equation. In particular, two themes are present in this section: (i) the practical usefulness of understanding value as the sum of book value plus the present value of future residual incomes, as opposed to the alternative, conventional and entirely equivalent specification of value as the present value of future dividends; and (ii) a shift in the financial accounting research agenda away from studies of the 'information content' of accounting signals towards the prediction of accounting fundamentals—future clean surplus earnings and book values—and the understanding of corporate valuation in terms of such fundamentals.

As with most of the edited books of readings in the Garland series (a series of which I heartily approve as a matter of principle—I have contributed a volume to it myself) and, in particular, the ones I know the best (those with specific editorial involvement from Dick Brief), it is well put together with an interesting mixture of the old and new. The book provides some well-known curiosities too, in terms of papers previously unpublished for one reason or another that, nonetheless, had impact. I enjoyed reading through the papers in this volume and, as with the question typically contained within teaching evaluation questionnaires, I can say that 'I really learned a lot'.

Further, and as an indication of the interesting range of papers found in the book, the juxtaposition between the perspectives found in the historical papers and that found in Ohlson's manuscript stimulated me to write a paper which attempts to look at these historical perspectives on the desirability of clean surplus income through the lens of Ohlson's linear information dynamics. Whether my efforts add to overall social welfare remains to be seen. Further, whether the book will stimulate all its readers to write a paper on the same subject is an empirical question. Nonetheless, I would argue that it is well worth the money to buy the book and find out.

Manchester Business School Andrew W. Stark

Readings in Accounting in the European Union. *A. Socias* (ed.). Universitat de les Illes Balears, Palma, 1996. 7-253 pp. Pts 2,000.

A European colleague, not in the UK, said when I mentioned this book: 'I looked at what it said about (my country) and discovered it was all wrong, so I assume that what it says about other countries is wrong as well.' This review is written in the belief that such a reaction, while in one sense entirely understandable, is unfairly and unhelpfully dismissive. A more pro-active response is required.

Readings in Accounting in the European Union attempts to make a contribution to the provision of alternative points of reference. All the papers are entirely or jointly authored by Spanish academics.

The editor's comment is worth quoting:

> 'It may be thought that it would have been preferable to choose other theoretically "more relevant" countries on a European Union level. We have checked that in the specialised journals in Europe, sufficient articles dedicated to those countries—as well as books—already exist, while other countries seem to have been forgotten, especially those in southern Europe.'

The first paper, by the editor, is an essay on the perceived paucity of progress towards harmonisation or standardisation. Although the paper's title refers to harmonisation, by the time we are halfway through the paper, the need is unequivocally for standardisation:

> 'An improvement in European accounting standardisation should affect all limited-liability companies (though with the acceptance of a certain differentiation) and not only the large groups of companies which are listed on the financial markets (which is what is intended)' (p. 34).

This is strong stuff, and represents an attitude increasingly regarded as idealistic or unperceptive (or both). This reader is not persuaded.

The second paper attempts to take six large quoted groups using six different European GAAPs and convert them to a single consistent GAAP. The Spanish group is taken as the 'norm', which gives an interesting slant for the non-Spanish reader. The adjustments made are often both subjective and of doubtful validity. For example, a Spanish rate of inflation adjustment, incorrectly described as a revaluation, is applied to German assets recorded at historical costs, a process which, to put it mildly, lacks obvious justification.

The third paper is a straightforward application of the Van der Tas indices (Van der Tas, 1988) to selected data from the first FEE survey (FEE, 1991). The fourth examines the treatment of formation expenses across the EU, concluding that both treatment and, equally importantly, definition, are distinctly variable.

The next paper is a comparative study of Italian and Spanish annual accounts post Fourth Directive. This seems to suffer from having two Spanish authors rather than one from each country. The paper makes two interesting propositions. The first is that Italian regulation 'freely' permits upward revaluations (p. 97), and the second is that such freedom is essential in order to be able to give a true and fair view (p. 109).

The second proposition is entirely justifiable in my view, but no attempt is made to justify it in the paper, and the authors and I could hardly claim to be in a European majority on this point. But unfortunately the first proposition is simply wrong because of Article 2426 of the Italian Code, which requires the principle of historical cost, and because of the general predominance of legalism over common sense in Italian accounting developments (see Zambon and Saccon, 1993:263). If you want to write about Italy, first catch your Italian.

The next two papers, on French and Spanish small businesses and consolidated accounts developments to date in the EU, are essentially surveys of relevant national regulations. The following one, on the audit profession in Europe, is one of the most problematic. The English is bad enough for it to matter. More importantly, much of the content is wrong (see my opening unattributed quotation). The research methodology is unclear. The 'references' suggest that original acts and decrees have been used as the (only) source material. However, this is obviously not the case. The UK material is certainly taken from technical or marketing public statements from ACCA and the ICAEW (chartered certified and chartered accountants respectively). I can largely work out which paragraphs came from which body. Since any comment is unique to the body making it, the material is at best only half right, and the whole is thoroughly misleading.

The final four papers form the editor's 'other problems' section. The first contrasts the 'Spanish' solution for dealing with prior year adjustments and changes in accounting methods—i.e. reflecting the changes in the income statement of the year in which they take place—with the 'IASC' solution—i.e. adjusting retained earnings brought forward and correcting the comparative figures. The former is said to give greater control and the latter to give greater comparability. The second of these papers is essentially arguing for the capitalisation of intangible marketing assets.

The penultimate paper explores some differences between US, IAS and Spanish regulations. Beyond the detail, the major conclusion is that the mutual recognition principle adopted in the EU shows a greater sophistication and maturity than the more overtly nationalistic US official attitude demonstrates. It seems hard to disagree. The final paper investigates the relationship between tax regulation and accounting practice, briefly covering Spain, the UK and Germany, sensibly arguing that differences are both less dramatic and more subtle than is generally implied in the literature.

Typically, a published book of 'readings' might be expected to give something of a summation of the current state of the art, and/or a creative and provocative platform for further development. This book does nothing of the sort. Many of the papers would benefit greatly from a constructive and ongoing peer review process—constructive both by reviewers and in the authors' response and willingness to make major changes and developments. The absence of a copy-editor who is a native English speaker is a critical omission.

But why did authors and editor find it necessary to publish their work in this form and at this non-advanced stage of development? Could the book be living proof that the editor's comment already quoted, that 'other countries seem to have been forgotten, especially those in southern Europe' is absolutely correct? Why have the EAA, EAR and EIASM, either as organisations or as communication channels for individual fellow-European academics, failed so far to integrate the authors of these papers into a truly European movement? If this book engenders a proper consideration of this final question, leading to real mutual progress, then it will have been justified a hundred-fold.

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University of Hull David Alexander

Accounting and Business Research

Strategic Choices, Environmental Uncertainty and SBU Performance: A Note on the Intervening Role of Management Accounting Systems

Loan Covenants and Relationship Banking in MBOs

The Effects of Outside Directors and Board Shareholdings on the Relation Between Chief Executive Compensation and Firm Performance

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Memorial

Professor Peter Brownell

As many of you know, Peter Brownell, one of Australia's leading academics, an invaluable colleague and a great friend of many, passed away on Sunday 16 March 1997, after a relatively long battle with lymphoma. He never gave in to this disease; he fought it hard and with great determination to the very end.

Peter was born on 24 November 1950, in Melbourne, Australia. From all reports, his focus on an accounting career developed by year 10 at Scotch College, and he threw his heart and soul into pursuing that career. He completed his honours degree at Melbourne University, and subsequently his PhD at the University of California-Berkeley. On graduation, he joined the faculty of the Massachusetts Institute of Technology as an assistant professor. On returning to Australia in 1983, he began work with the Australian Graduate School of Management. In 1985 he took up an appointment as professor of accounting at Macquarie University, a position he held until 1991 when he joined the faculty of the University of Melbourne, also as professor of accounting.

Peter's contribution to the world of accounting and, in particular, behavioural accounting, has been outstanding. He published profusely, mainly in *The Accounting Review*, the *Journal of Accounting Research*, *Accounting, Organizations and Society*, *Journal of Accounting Literature* and *Accounting and Finance*. His work has provided inspiration, encouragement and a pathway for many undergraduate and postgraduate students, a considerable number of whom are now faculty members of universities around the globe. His work set out the standard for others.

In his pursuit of research excellence, Peter always found time to encourage and motivate those who were his students or his colleagues; no matter how busy he was. He never failed to attend to their needs, providing advice and encouragement to them to push ahead. He developed many friendships in the process, always seeing life in a positive sense, never failing to share his many interests with those around him.

That Peter Brownell will be sadly missed is an understatement. His loss is immeasurable.

Alan Dunk

As the editorial team of this journal, we wish to acknowledge our gratitude to Peter Brownell for the excellent service he provided in his capacity as a regular referee. Peter has been an exemplary referee, managing always in his reports to authors to be very constructive while preserving the highest academic standards. He will be sorely missed.

Ken Peasnell
Mahmoud Ezzamel
Peter Moizer

Accounting and Business Research, Vol. 27. No. 4. pp. 268-276. 1997

Strategic Choices, Environmental Uncertainty and SBU Performance: A Note on the Intervening Role of Management Accounting Systems

Vincent K. Chong and Kar Ming Chong*

Abstract—This paper examines the role of management accounting systems (MAS) design on the relationship between: (1) strategic business unit (SBU) strategy and SBU performance and (2) perceived environmental uncertainty (PEU) on SBU performance. MAS design was defined in terms of the extent to which managers use broad scope MAS information for managerial decision making. The responses of 62 SBU managers, drawn from a cross-section of manufacturing companies in Western Australia, to a questionnaire survey were analysed by using a path analysis. The results suggest that SBU strategy and PEU are important antecedents of MAS design, and that broad scope MAS information is an important antecedent of SBU performance.

1. Introduction

A number of studies have examined the relationship between contextual variables and management accounting systems (MAS) design[1] on performance. However, research on the relationship between strategy and MAS design on performance is still very limited. An understanding of the impact of strategic choices on management control systems[2] design has been argued as a research imperative (Otley, 1980; Dent, 1990; Simons, 1987, 1990).[3] Simons (1987: 357), for example, points to 'the potential importance of understanding the relationship between strategy and accounting control systems as a prerequisite to the development of general theories concerning accounting control systems in complex organisations'.

Previous studies (e.g., Govindarajan, 1986, 1988; Gupta, 1987) have examined the linkage between strategy and perceived environmental uncertainty (PEU) on firms' performance without explicitly considering the role of accounting information. Other studies (e.g. Gul, 1991; Mia, 1993; Gul and Chia, 1994) have provided strong empirical evidence to support the proposition that PEU affects MAS design and performance. How-

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*The authors are at the Edith Cowan University, Western Australia. They wish to thank A. Rashad Abdel-khalik, Alan Dunk, Mike Gibbins, Ferdinand Gul, Amy Lau, Ken Peasnell and the two anonymous reviewers for their helpful suggestions and comments on earlier drafts of this paper. Comments by Chong Lau and Gary Monroe are appreciated. An earlier version of this paper was presented at the Accounting Research Group Seminar Series at Edith Cowan University; the Accounting Research Seminar at Curtin University of Technology; and the 1996 Eighth Asian-Pacific Conference on International Accounting Issues, Vancouver, Canada. This research project was supported by a special research grant from the Faculty of Business at Edith Cowan University to the second-named author. Correspondence should be addressed to Vincent K. Chong, School of Accounting, Faculty of Business, Edith Cowan University, Pearson Street, Churchlands, Western Australia 6018. This paper was first submitted in March 1996 and accepted in June 1997.

[1] MAS design is defined in terms of certain information characteristics, such as breadth of scope, levels of aggregation, its integrative nature and timeliness (see Chenhall and Morris (1986) for a detailed discussion of these information characteristics).

[2] The MAS is considered a control sub-system of 'an overall organisational control package' (see Otley, 1980:421).

[3] Miles and Snow (1978) identified three viable generic competitive archetypes: prospector, analyser and defender while Porter (1980) also identified three viable generic competitive strategies: overall cost leadership, differentiation and focus. In addition, Govindarajan and Gupta (1985) examined the location of an organisation's strategic posture along a continuum from 'build' and 'harvest' strategies. These generic typologies have been the subject of extensive empirical and theoretical investigation. There is general consensus that build, differentiation and prospector-type strategy, and harvest, cost leadership and defender-type strategy are conceptually similar (Chrisman, et al., 1988).

ever, these studies did not consider the potential impact of strategy. This study is, therefore, an attempt to integrate the two strands of research in the literature (i.e. strategy-PEU-performance linkage and PEU-MAS-performance linkage) by explicitly examining the intervening role of MAS on the linkages between strategy and PEU on strategic business unit (SBU) performance.

The remainder of the paper is structured as follows. First, a theoretical discussion of the proposed linkages and the statements of hypotheses are provided. This is followed by sections discussing the research method, results, discussion, limitations and conclusions.

2. Theoretical development and hypotheses formulation

Previous studies (e.g. Chandler, 1962; Downey and Slocum, 1975; Biggadike, 1979; Miles and Snow, 1978; Simons, 1987; Govindarajan, 1986, 1988; Gupta, 1987) have suggested that a firm pursuing a prospector-type strategy was associated with high levels of perceived environmental uncertainty (PEU).[4] Conversely, a defender-type firm was associated with relatively low levels of PEU (Miles and Snow, 1978; Miller, 1988; Miller et al., 1988).[5] Gordon and Narayanan (1984: 42) found that 'as decision makers perceive greater environmental uncertainty, they tended to seek external, non-financial and ex ante information in addition to other types of information'. Chenhall and Morris (1986) found that there is a positive relationship between PEU and a need for information that has broad scope.[6] Gul and Chia (1994) suggested that when PEU is low, management is able to make relatively accurate predictions about the market. However, when PEU is high, management may require additional information to cope with the complexities of the environment. More sophisticated reports from the MAS can help to reduce uncertainty and improve managerial decision-making (Gul and Chia, 1994).

Firms pursuing a prospector-type strategy locate and exploit product and market opportunity through monitoring a wide range of environmental conditions and events. Their product domain is continually developing, and technologies employed are typically flexible to enable quick reactions to changing demands in the market-place. As a result, *external, non-financial and future-oriented information* would be appropriate for managers. Accordingly, broad scope MAS information would be perceived to be useful for decision-making. In contrast, defender-type firms operate in a stable and narrow product market. They emphasise efficiency rather than innovation. The stability of their market is congruous with a reliance on historical information. Their narrow product domain reduces the need for extensive monitoring of the external environment conditions. Accordingly, narrow scope MAS information would be appropriate for managers of defender-type firms.

2.1. Linkages Between SBU Strategy, MAS and SBU Performance

The first hypothesis is concerned with the relationships between SBU strategy, broad scope MAS information and SBU performance. It has been suggested that an organisation pursuing a prospector-type strategy exposes itself to a wide environmental domain. A greater amount of information would therefore be required, and managers are likely to use broad scope MAS information to cope with uncertainty (Thompson, 1967; Galbraith, 1973; Mia, 1993). Conversely, if an organisation chooses a defender-type strategy, the environment in which it operates will be relatively stable. This, in turn, will induce managers to rely on narrow scope MAS information for decision-making. Thus, it may follow that managers operating in a prospector-type firm will require broad scope MAS information, while managers operating in a defender-type firm will require narrow scope MAS information. Abernathy and Guthrie (1994) found that the use of broad scope MAS information had a more positive impact on performance in prospector-type firms than in defender-type firms.

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[4] PEU is operationalised in terms of the managers' perceptions about the predictability and stability in various aspects of their organisation's external environment, such as the competitors' actions in the market, economic and technological changes and customers' preferences (Gordon and Narayanan, 1984). Our study focuses on managers' perceptions of uncertainty, rather than any objective measures of such uncertainty (Dill, 1958; Duncan, 1972; Weick, 1969; Downey and Slocum, 1975; Downey, et al., 1975). Consequently, only the decision environment at the organisational (macro) level, that is, the portion of the total environment affecting the decision-making function of an organisation, is relevant (Dill, 1958; Thompson, 1967).

[5] Our study focuses on the two extreme strategic postures (i.e. prospectors and defenders) of Miles and Snow's typology at the SBU level. *Prospectors* are innovators, flexible and entrepreneurial in their outlook and continually undertake a relatively high rate of new products and market development. *Defenders* operate in relatively stable product areas and focus on maintaining market share through cost leadership, quality, and service. They engage in little product and market development. While several business unit strategy taxonomies have been developed (e.g. Porter, 1980; Mintzberg, 1973; Utterback and Abernathy, 1975; Miller and Friesen, 1978; Miles and Snow, 1978), our study examines competitive strategy at the business unit level based on the Miles and Snow (1978) typology for a number of reasons. First, the Miles and Snow typology provides the best basis to develop a theoretical framework useful for identifying the characteristics of information systems that will be appropriate in different strategic contexts (Simons, 1987). Second, this typology exhibits similar characteristics to strategy archetypes identified in other studies, including entrepreneurial and planning mode firms (Mintzberg, 1973), performance maximising and cost minimising firm (Utterback and Abernathy, 1975), innovators and dominant firms (Miller and Friesen, 1978), and cost leadership and differentiation (Porter, 1980). Third, Miles and Snow's typology is one of the most widely used and has been found to be a useful means of classifying generic strategies across a wide range of industries. Finally, the Miles and Snow's typology has been subjected to considerable psychometric assessment (Hambrick, 1979; Hambrick, 1983; Snow and Hambrick, 1980; Shortell and Zajac, 1990).

[6] The scope of MAS information refers to the dimension of focus, quantification and time horizon (Chenhall and Morris, 1986). Such information has been identified by accounting researchers (e.g. Mia, 1993; Gul and Chia, 1994; Mia and Chenhall, 1994; Abernathy and Guthrie, 1994; Chong, 1996) as an information characteristic of MAS having particular significance in assisting managerial decisions. The *broad* scope MAS information includes external, non-financial and future-oriented information while the *narrow* scope MAS information includes internal, financial and historical information (Chenhall and Morris, 1986).

Thus far, it has been suggested that prospector-type strategy may induce managers to use broad scope MAS information for decision-making. This implies that the impact of broad scope MAS information acts as an intervening construct between SBU strategy and SBU performance. Hence, it can be postulated that the relationship between SBU strategy and SBU performance may be due, in part, to the indirect effect of the extent to which managers use broad-scope MAS information for decision-making. Thus, the following hypothesis is suggested:

> H_1: There is an indirect relationship between SBU strategy and SBU performance through the extent to which managers use broad-scope MAS information for decision-making.

2.2. *Linkages between PEU, Broad scope MAS Information and SBU Performance*

The second hypothesis is concerned with the relationships between PEU, broad scope MAS information and SBU performance. Previous accounting literature suggests that as PEU increases, managers will consider external, non-financial and ex ante MAS information to be increasingly important and useful for their decision-making (Gordon and Narayanan, 1984; Chenhall and Morris, 1986). Recent studies (e.g. Gul, 1991; Gul and Chia, 1994; Mia, 1993; Mia and Chenhall, 1994) have confirmed the relationship between PEU and broad scope MAS information on performance. Mia (1993), for example, found that the use of broad scope MAS information acted as a mediator in the relationship between PEU and performance. Mia concluded that as the managers' PEU increased, their use of broad scope MAS information also increased. An explanation for Mia's argument was that under conditions of high PEU, the use of broad scope MAS information might help managers to gather more useful information to improve the accuracy of their decisions. Gul (1991) concluded that under high levels of PEU, sophisticated MAS information has a positive effect on performance, but under low levels of PEU, it had a negative effect. Gul and Chia's (1994) study concluded that decentralisation and the availability of MAS information characteristics in terms of broad scope and aggregation were associated with higher managerial performance under conditions of high PEU. On the other hand, decentralisation and the availability of MAS information characteristics in terms of broad scope and aggregation were associated with lower managerial performance under conditions of low PEU.

Thus far, it has been suggested that high PEU may induce managers to use broad scope MAS information for decision-making. This implies that the impact of broad scope MAS information acts as an intervening variable between PEU and SBU performance. Hence, it can be postulated that the relationship between PEU and SBU performance may be due, in part, to the indirect effect of the extent to which managers use broad scope MAS information for decision-making. This idea is formally expressed in the following hypothesis:

> H_2: There is an indirect relationship between managers' PEU and SBU performance through the extent to which managers use broad scope MAS information for decision-making.

3. Research method

3.1. *Sample*

The research method involved administering a questionnaire to a sample of 87 SBU managers of manufacturing companies randomly chosen from *Kompass Australia* (1994/95). The criteria for inclusion in the sample were as follows: (1) the business units were required to have an identifiable business strategy; (2) the respondents were required to have responsibility for operations within the business unit; and (3) the companies must have at least 100 employees in the organisation.[7] Each

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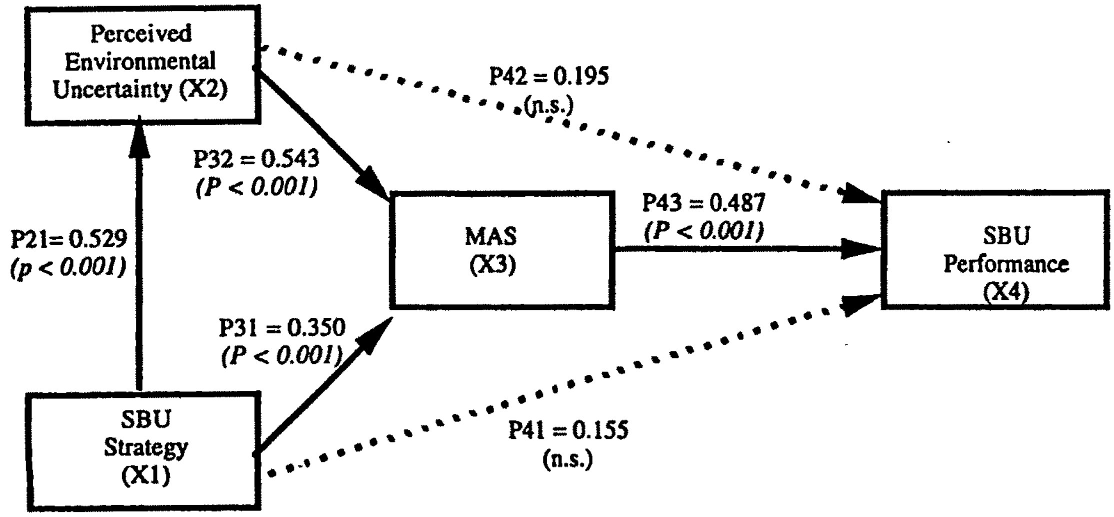
[7] It is expected that firms with fewer than 100 employees are unlikely to have clearly defined areas of responsibilities (Brownell and Dunk, 1991). A total of 130 manufacturing companies were randomly selected. From the 130 companies, the names of 250 managers were gathered. Telephone calls were made to each manager to ensure that the criteria for sample inclusion were satisfied and to ascertain whether they were willing to participate in the project. 163 managers were not included in our sample for a number of reasons. First, they failed to meet our criteria. Second, they could not be contacted or had left the companies. Finally, some of the companies had ceased operations or moved. Our final sample consists of 87 SBU managers and a wide range of industries. These industries include electrical and electronics products, consumer durables, furniture, printing, steel and metal products, wire and cable, plastic, rubber and tyre, medical and health care products, textile, clothing and footwear.

Figure 1
Path coefficients



participant was sent a questionnaire together with a covering letter and a prepaid self-addressed envelope for the questionnaire to be returned directly to the researchers.[8] Questionnaires were precoded to enable non-respondents to be traced and followed-up. A follow-up letter was sent to those who had not responded after two weeks.

A total of 70 questionnaires were returned and eight questionnaires were excluded from the study for incomplete responses. This left the study with 62 usable questionnaires for data analysis; a usable response rate of 71.26%. The respondents had held their current positions for an average of six years and had been employed by their respective companies for an average of 9.8 years. The average length of experience in the area they managed was 9.5 years and the average number of employees in their areas of responsibility was 106. The average number of employees in the sample firms was 360 employees.

3.2. Variable Measurement

SBU strategy. SBU strategy was measured based on Miles and Snow's (1978) strategic typology. Managers were asked to select the descriptions of prospector and defender-type strategy which most closely matched their business units. This instrument has been subjected to considerable psychometric assessment (Snow and Hrebiniak, 1980; Hambrick, 1983; Shortell and Zajac, 1990) and has been used in other accounting studies (e.g. Simons, 1987; Abernathy and Guthrie, 1994).[9]

Perceived environmental uncertainty. Perceived environmental uncertainty was measured using a seven-item, seven-point Likert-type scale instrument developed by Gordon and Narayanan (1984). The seven items were designed to measure the respondents' perceptions about the predictability and stability in various aspects of their organisation's industrial, economic, technological, competitive and customer environment. The Cronbach alpha coefficient (Cronbach, 1951) was 0.95, which indicated very high internal reliability for the scale (Nunnally, 1967).

Broad scope MAS information. Broad scope MAS information was measured by a six-item, five-point Likert-type scale developed by Chenhall and Morris (1986), and widely used by other accounting researchers (e.g. Abernathy and Guthrie, 1994; Mia and Chenhall, 1994; Gul and Chia, 1994; Chong, 1996). The Cronbach alpha coefficient (Cronbach, 1951) was 0.92, which indicated very high internal reliability for the scale (Nunnally, 1967).

SBU performance. SBU performance was measured by a self-rating scale using an instrument originally developed by Govindarajan (1984) and subsequently used by other accounting researchers (e.g. Govindarajan and Gupta, 1985; Abernathy and Guthrie, 1994). Managers were required to rate each of the 12 dimensions[10] on a five-point Likert-type scale, ranging from 1 'of little importance' to 5 'extremely important', indicating the degree of importance attached by his superiors to his business unit's performance on that dimension. Next, the managers were asked to rate on each of the 12 dimensions SBU performance as compared with his/her assessment of their superiors' expectations of the SBU along that dimension. Again, a five-point Likert-type scale ranging from 1 'not at all satisfactory' to 5 'outstanding' was used. Using the data on the dimensional importance obtained as weights, a weighted average SBU performance index was obtained. The Cronbach alpha coefficient (Cronbach, 1951) was 0.95, which indicated very high internal reliability for the scale (Nunnally, 1967).

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[8] Copies of the questionnaire are available from the authors.

[9] Previous studies (see Miller, 1988, Govindarajan, 1988; Miles and Snow, 1978) have supported the view that managers in firms pursuing prospector-type strategy were likely to perceive a significantly higher level of environmental uncertainty than those managers of defender-type firms. We conducted a point-biserial correlation between strategy and PEU. Our results indicated that the relationship was significant and positive ($r = 0.525$, $p < 0.001$), thus providing some indirect support for the validity of the SBU strategy construct.

4. Results

A path analytic technique was used to test the hypothesised relationships. This technique allows examination of the direct, indirect and spurious effects (Duncan, 1966; Alwin and Hauser, 1975; Asher, 1976; Greene, 1977; Lewis-Beck, 1980). Appendix A shows the decomposition of the direct, indirect and spurious effects. The equations in the path model are shown as follows:

$$\chi_2 = P_{21}\chi_1 + P_{2a}R_a \qquad (1)$$
$$\chi_3 = P_{31}\chi_1 + P_{32}\chi_2 + P_{3b}R_b \qquad (2)$$
$$\chi_4 = P_{41}\chi_1 + P_{42}\chi_2 + P_{43}\chi_3 + P_{4c}R_c \qquad (3)$$

where χ_i = the variables measured; P_{ij} = the standardised partial regression coefficients (path coefficients); R_i = the standardised residuals.

The descriptive statistics and zero-order correlation coefficients for all variables are presented in Tables 1 and 2 respectively.[11] The results presented in Table 3 were used to compute the magnitudes of the direct and indirect effects in the path model (see Figure 1). The results presented in Table 4 indicate the presence of direct effects: (1) between SBU strategy and PEU; (2) between SBU strategy and broad scope MAS information; (3) between PEU and broad scope MAS information; and (4) between broad scope MAS information and SBU performance.

Hypotheses H_1 and H_2 were tested by examining the decomposition of the zero-order correlation coefficients between: (1) SBU strategy/SBU performance linkage and (2) PEU/SBU performance linkage. Line 4 of Table 4 presents the decomposition of SBU strategy/SBU performance linkage. The results show that a significant positive zero-order correlation coefficient ($r_{14} = 0.568$, $p < 0.001$) exists between SBU strategy and SBU performance. The decomposition of the zero-order correlation coefficient between SBU strategy and SBU performance shows an insignificant direct effect ($P_{41} = 0.155$, n.s.), supplemented by a positive and significant indirect effect between SBU strategy on SBU performance through the extent to which managers use broad scope MAS information. This result provides support for hypothesis H_1.

Line 5 of Table 4 presents the decomposition of PEU/SBU performance linkage. The results show that a significant positive zero-order correlation coefficient ($r_{42} = 0.632$, $p < 0.001$) exists between PEU and SBU performance. The decomposition of the zero-order correlation coefficient between PEU and SBU performance shows an insignificant

Table 1
Descriptive statistics

Variables		*Mean*	*Standard deviation*	*Theoretical range*		*Actual range*	
				Min	*Max*	*Min*	*Max*
χ_1	SBU strategy	—	—	0.00	1.00	0.00	1.00
χ_2	PEU	4.29	1.60	1.00	7.00	1.20	6.80
χ_3	Broad scope MAS information	3.24	1.21	1.00	5.00	1.00	5.00
χ_4	SBU performance	3.53	0.79	1.00	5.00	1.42	4.83

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[10] The 12 dimensions are: sales growth rate, market share, operating profits, profit to sales ratio, cash flow from operations, return on investment, new product development, market development, R&D, cost reduction programmes, personnel development and political/public affairs.

[11] The zero-order correlation describes the total association between two variables. Total association includes total effects and spurious effects. The total effects of one variable on another comprises both direct and indirect effects. Spurious effects is equal to the difference between total association and total effects (see Duncan, 1966; Alwin and Hauser, 1975; Asher, 1976; Greene, 1977; Lewis-Beck, 1980 for a detailed discussion).

Table 2
Correlation matrix[a]

		χ_1	χ_2	χ_3	χ_4
χ_1	SBU strategy	1.000			
χ_2	PEU	0.529*	1.000		
χ_3	Broad scope MAS information	0.637*	0.728*	1.000	
χ_4	SBU performance	0.568*	0.632*	0.728*	1.000

*Significant at 0.001 level

[a]The calculation of zero-order correlation coefficients assumes that all variables have been measured using an interval scale. In our study, SBU strategy has been measured as a dichotomous variable and therefore violates an important assumption implicit in this measure. The point-biserial correlation coefficients were performed for the dichotomous variables (see Baggaley, 1964: 18–33; Kaplan, 1987).

direct effect ($P_{42} = 0.195$, n.s.), supplemented by a positive and significant indirect effect between PEU on SBU performance through the extent to which managers use broad scope MAS information. This result provides support for hypothesis H_2.

5. Discussion, limitations and conclusions

Our results provide additional evidence on the role of MAS design on the relationship between: (1) an organisation's strategic priorities and SBU performance; and (2) perceived environmental uncertainty and SBU performance. Our results suggest that SBU strategy and PEU are important antecedents of MAS design. Support was also found for broad scope MAS information to be an important antecedent of SBU performance. In this light, our results relating to SBU strategy, managers' use of broad scope MAS information and SBU performance are consistent with previous studies (e.g. Abernathy and Guthrie, 1994). In ad-

Table 3
Results of regression[a]

Panel A: Equation (1): $\chi_2 = P_{21}\chi_1 + P_{2a}R_a$

Variable	*Path coefficient*	*Coefficient value*	*T value*	*P*
χ_1 SBU strategy	P_{21}	0.529	4.829	0.001

Adjusted $R^2 = 0.268$; $R^2 = 0.280$; $F_{1,60} = 23.323$; $p < 0.001$

Panel B: Equation (2): $\chi_3 = P_{31}\chi_1 + P_{32}\chi_2 + P_{3b} R_b$

Variable	*Path coefficient*	*Coefficient value*	*T value*	*P*
χ_1 SBU strategy	P_{31}	0.350	3.690	0.001
χ_2 PEU	P_{32}	0.543	5.729	0.001

Adjusted $R^2 = 0.605$; $R^2 = 0.618$; $F_{2,59} = 47.779$; $p < 0.001$

Panel C: Equation (3): $\chi_4 = P_{41}\chi_1 + P_{42}\chi_2 + P_{43}\chi_3 + P_{4c}R_c$

Variable	*Path coefficient*	*Coefficient value*	*T value*	*P*
χ_1 SBU strategy	P_{41}	0.155	1.369	n.s.
χ_2 PEU	P_{42}	0.195	1.533	n.s.
χ_3 Broad scope MAS information	P_{43}	0.487	3.475	0.001

Adjusted $R^2 = 0.543$; $R^2 = 0.565$; $F_{3,58} = 25.158$; $p < 0.001$

[a]Tests on the adequacy of the regression models indicate that the assumptions of the models were satisfied by the data. Tests for normality indicate that the results of each model are fairly normally distributed. To diagnose multicollinearity, we examined the variance inflation factors (VIFs) for the predictors. Our VIFs ranged from a low value of 1 to a high value of 2.62.

Table 4
Decomposition of direct and indirect effects

Path linkages	*Zero-order correlation*	*Direct effects*	*Indirect effects*	*Spurious effects*	*Unanalysed relation*	*Total relation*
From SBU strategy (χ_1) to PEU (χ_2)	0.529	0.529	—	—	—	0.529
From SBU strategy (χ_1) to broad scope MAS information (χ_3)	0.637	0.350	—	—	0.287	0.637
From PEU (χ_2) to broad scope MAS information (χ_3)	0.728	0.543	—	—	0.185	0.728
From SBU strategy (χ_1) to SBU performance (χ_4)	0.568	0.155	0.413	—	—	0.568
From PEU (χ_2) to SBU performance (χ_4)	0.632	0.195	0.437	—	—	0.632
From broad scope MAS information (χ_3) to SBU performance (χ_4)	0.728	0.487	—	0.241	—	0.728

dition, our results relating to PEU, managers' use of broad scope MAS information and performance are also consistent with prior studies (e.g. Mia, 1993; Gul, 1991; Gul and Chia, 1994).

Several limitations of the study should be noted. First, the use of only the extreme strategies (defenders-prospectors) from Miles and Snow's (1978) typology is a potential limitation of our study. Miles and Snow have identified a third profitable strategy, analyser, which is located between defenders and prospectors. Analysers makes fewer and slower product/market changes than do prospectors, and they are less committed to stability and efficiency than are defenders. Miles and Snow (1978) expect that the information needs of this strategy type are fundamentally different from defenders and prospectors. It is possible that some business units within the sample were actually pursuing an analyser-type strategy.

A second limitation of our study is concerned with our sample, which was selected from manufacturing industries. Generalising our results to other industries (such as service industries) should be done cautiously. Third, the use of a self-rating scale to measure SBU performance is likely to have higher mean values (higher leniency error) and a restricted range (lower variability error) in the score (Thornton, 1968; Prien and Liske, 1962). Fourth, our study examines only one dimension of MAS information characteristic.

Finally, the path model implies causality. We are unable to assess the possibility that SBU performance affects MAS design (i.e. the opposite causal direction). The survey research methodology allows for examination of statistical associations at one point in time, and the statements about the direction of relationships can only be made in terms of consistency of results with the effects proposed in the theoretical discussion. Future research could employ different research methods (e.g. longitudinal field studies) to systematically investigate the theoretical causal relationships proposed in our study.

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Appendix A
Decomposition of direct, indirect and spurious effects in the path model

Path linkages	*Zero-order correlation*	*Direct effects*	*Indirect effects*	*Spurious effects*	*Unanalysed relation*
From SBU strategy (χ_1) to PEU (χ_2)	r_{12}	P_{21}	—	—	—
From SBU strategy (χ_1) to broad scope MAS information (χ_3)	r_{13}	P_{31}	—	—	$P_{32}\ r_{12}$
From PEU (χ_2) to broad scope MAS information (χ_3)	r_{23}	P_{32}	—	—	$P_{31}\ r_{12}$
From SBU strategy (χ_1) to SBU performance (χ_4)	r_{14}	P_{41}	$P_{42}r_{12}+P_{43}r_{13}$	—	—
From PEU (χ_2) to SBU performance (χ_4)	r_{24}	P_{42}	$P_{41}r_{12}+P_{43}r_{23}$	—	—
From broad scope MAS information (χ_3) to SBU performance (χ_4)	r_{34}	P_{43}	—	$P_{41}r_{13}+P_{42}r_{23}$	—

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Loan Covenants and Relationship Banking in MBOs

David Citron, Ken Robbie and Mike Wright*

Abstract—This paper examines the role of accounting-based covenants and other sources of information in signalling financial distress in UK MBOs. Using an in-depth questionnaire and follow-up interviews to investigate the perceptions of senior UK MBO lenders, we find that: MBO loan agreements contain more covenants than general corporate lending agreements; monthly management accounts and telephone communication are more frequent first indicators of distress than are accounting-based covenant breaches; lenders with specialist MBO lending units are more likely to waive covenant breaches and less likely to recall loans in default than those without such units; syndicate members find both information flows prior to breach and subsequent action taken to be less effective than do syndicate leaders or sole lenders; and the presence of a specialist MBO lending unit provides the skills and reputation needed to establish a high degree of trust between the banks on the one hand and the MBOs and the equity houses on the other, but there is wide variety in the ways that banks manage these relationships. These findings confirm the expectation that the relatively more acute adverse selection and moral hazard problems inherent in MBO lending increase the demand for monitoring via covenants, and that the closer the lender/borrower relationship, the more effective the monitoring.

1. Introduction

A voluminous literature has now developed concerning the effects of management and leveraged buyouts, investigating the reductions in information asymmetry, reductions in internal agency costs, wealth transfers arising from the renegotiation of implicit contracts, and wealth transfers arising in former parent companies arising from the changed risk of the organisation (see Fox and Marcus, 1992; Jensen, 1993; Thompson and Wright, 1995, for reviews). A particularly important argument, and the focus of this paper, is that leveraged buyout firms achieve operating efficiencies due to the discipline and monitoring imposed by high leverage (Jensen, 1986; Wruck, 1990). Furthermore, if such firms become distressed, timely loan default should ensure that they are more likely to be rescued before their going concern value dissipates. Beneish and Press (1995a), however, find for non-LBOs in default that the cost of additional constraints imposed by lenders outweighs the benefits of increased monitoring.

Furthermore, studies of firms breaching covenants have focused on those firms that have violated accounting-based covenants alone (see, for example, Beneish and Press, 1993, and Chen and Wei, 1993, on the costs of breach; and DeFond and Jiambalvo, 1994, and Sweeney, 1994, on accounting responses to breaches). However, lenders often require a range of both accounting-based and non-accounting-based covenants, and it is possible that these interact as firms approach default. In this spirit, Smith (1993) suggests that research into technical default needs to be integrated into a broader view of the lending process (p. 301). Similarly Singh (1993) makes a plea for introducing more institutional detail into studies of corporate restructuring, by which he means 'a precise understanding of the actual mechanics of decision-making' (p. 164).

In order to gain a deeper understanding of both the formal and informal monitoring processes, this study uses (a) a questionnaire to investigate the perceptions of 29 UK MBO lenders on the loan monitoring process[1], in particular as borrowers enter financial distress; and (b) interviews with the majority of specialist MBO lending units among our respondents to investigate the nature of the bank/MBO relationship in greater depth. We focus on the MBO sector because of the relatively more acute adverse selection and moral hazard problems associated with MBO lending, as a result of which we expect close monitoring to be an important feature of the MBO lender/borrower relationship. In this connection the paper draws on certain features of relationship banking, as a means of addressing agency cost problems, to place the insights of Jensen and Wruck into a broader view of the lending process. Thus Mayer (1988) sees the chief characteristics of close relationships as comprising 'procedures for evaluating prospective borrowers, monitoring the performance of borrowers and, most crucially of all, reacting to instances of financial distress' (pp. 1,180–1). Similarly, Holland's case studies lead him to the view that 'close relationships generally involve rich information flows ... high loyalty and commitment between parties and expectations of fair dealing and longevity of relationship' (1994:372).

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*David Citron is at the City University Business School; Ken Robbie and Mike Wright are at the Centre for Management Buyout Research, University of Nottingham. They gratefully acknowledge financial support for CMBOR from BZW Private Equity and Deloitte & Touche Corporate Finance. Thanks also to seminar participants at the Universities of Nottingham and Leeds and City University Business School, two anonymous referees and the editor of this journal, who provided helpful comments on an earlier version. Correspondence should be addressed to D. B. Citron, City University Business School, Department of Accounting and Finance, Frobisher Crescent, Barbican Centre, London EC2Y 8HB. This article was submitted in June 1996 and accepted in April 1997.

[1] In what follows, unless otherwise stated, the term MBO is used as a shorthand for MBOs and MBIs.

Finally, previous research, in investigating different types of debt, has focused on the distinction between public and private lending. However, lender/borrower relationships are also likely to be affected by whether the lender is a sole lender or syndicate lender as compared with being merely a syndicate member (see Smith, 1993:298). This paper adds to previous research by exploring the implications of this distinction for MBOs in loan default.

The remainder of the paper consists of six sections. The theoretical framework for the research is contained in the next section and this is followed by a brief descriptive section on recent trends in MBO/MBI lending in the UK. Section 4 sets out the data and research methodology, and Sections 5 and 6 contain the findings. The paper concludes with a summary and discussion of implications for future research.

2. Theoretical framework

There is a well-known agency cost involved in the general provision of debt that arises from the potential conflict of interest between equity holders and debt providers (Smith and Warner, 1979). Debt covenants provide a means of controlling the moral hazard problems that may arise in monitoring management. For debt covenants to be effective in addressing moral hazard problems, there is a need for them to be set at appropriate levels, for there to be an associated regular flow of (unbiased) information from the borrower to the lender, and for there to be timely and appropriate action by lenders when such covenants are breached.

In a recent review of research into accounting-based covenant violations, Smith argues that 'further progress requires the integration of technical default into a broader view of the lending process' (1993:301). This is because accounting-based covenants are merely a subset of the undertakings that characterise the borrower/lender relationship. One aspect of research which has addressed this dimension is that of Rajan and Winton (1995), who examine the role of covenants as a contractual device to increase lenders' incentives to monitor, that is, they provide incentives for lenders to take action and obtain information on which to base action. A proper understanding of their role, therefore, requires an understanding of the wider context within which they operate.

One particularly important feature of this wider context is that the borrower/lender relationship rests on informal as well as formal contracts (Holland, 1994). Holland points out that agency theory provides a useful starting point for studying bank-corporate relationships, but recognises that the theory requires further development to be applicable to more complex relationships. Binks and Ennew (1996) address the issue of bank-client relationships in a principal-agent context, arguing that such relationships may help deal with asymmetric information problems through the building of trust and confidence, which results in an increased flow of information between the corporate client and the bank. There is also an emerging literature from a trust and procedural justice perspective which suggests that relationships are complementary to the traditional approach of agency theory, as they can be viewed as alternatives to costly formal contracts in the monitoring of financier-investee relationships (e.g. Welbourne et al., 1995; Sapienza and Korsgaard, 1996).[2] Sapienza and Korsgaard (1996), in a study of the relationships between venture capitalists and entrepreneurs, which have similar properties to those involving banks and corporate clients, explicitly link their approach to agency theory. In particular they find that timely provision of information to financiers promotes positive relationships (mutual trust and commitment, etc.) between investees and venture capital firms which in turn can be viewed as a bonding mechanism that reduces the principal's need to expend effort monitoring (p. 550).[3] This paper aims to contribute to this body of research by exploring bank-corporate relationships in more depth in the context of MBO lending. Accounting-based covenants are clearly an integral part of the formal contractual structure. It is likely, however, that their use will interact with both other formal and informal flows of information. This paper seeks to enhance our understanding of the functioning of accounting-based covenants in the wider setting of the formal and informal loan monitoring process.

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[2] Much of the now extensive literature concerning venture capital firms' monitoring of investee companies has taken an agency theory perspective, e.g. Sahlman (1990) and Mitchell et al. (1995) (who both include buyouts), but has subsequently been extended to include relationships (e.g. Korsgaard et al., 1995; Sapienza and Korsgaard, 1996). Procedural justice theory focuses on the importance of developing relationships in situations where the parties do not have direct or full control.

[3] They also note that this can mitigate fears of opportunism.

We select MBO lending as a particularly appropriate context for this investigation for a number of reasons. First, MBO lenders can be expected to make greater use of a wider variety of both accounting-based and non-accounting-based covenants in their loan agreements than are found in general lending agreements. This is because the problems of both moral hazard and adverse selection are likely to be more acute in MBOs than in general corporate lending situations.

Research into the agency costs of debt generally makes the assumption that the interests of management and shareholders coincide. Garvey and Swan (1994), however, summarising recent literature on management turnover in distressed firms, question the assumption that managers are always willing to act against the interests of lenders even when it means courting financial distress. Where managers are in fact significant equity holders, as in MBOs, and even though they are undiversified investors, there are strong arguments to suggest that share ownership provides increased incentives to invest in risky projects, so increasing the probability of failure. However, emerging evidence on post-transaction performance across the full range of buyout types indicates that managers engage in both cost-cutting as well as innovative, more risky activities, such as new product development (Wright, Thompson and Robbie, 1992; Phan and Hill, 1995; Zahra, 1995).[4] Wright, Thompson and Robbie (1992) find that 62% of their sample introduce new products which respondents claimed would not otherwise have been done. Zahra (1995) compares pre- and post-buyout commitments to corporate entrepreneurship and finds that after buyout there is an increased commitment to new product development, a greater emphasis on commercialising technology and a greater intensity of new venture efforts, but that research and development expenditure did not change significantly. Phan and Hill (1995) show that management equity holdings have a more significant impact on changes in growth strategies than does the role of debt.

The moral hazard problems associated with monitoring managers in buyout companies may be particularly acute because incumbent management's relative information advantage may persist for some time after the MBO has been effected. Such an advantage is likely to diminish over time as the flow of information to lenders, together with the monitoring relationship, may be expected to make them better informed. Finally, competition for lending to a buyout within a short timescale to deal completion also raises adverse selection problems in that such pressures may mean that management's assumptions about future performance are inadequately scrutinised.[5] Banks lending to an MBO may thus be viewed as facing a Winner's Curse type of problem, in the sense that the bank winning the mandate lends to an over-priced transaction (i.e. lends on more favourable terms than competing banks) because of a greater degree of asymmetry of information regarding the 'true' position of the firm, or a more favourable assessment of available information. This issue may be exacerbated, as MBO lending is typically lending by *new* bankers to a firm with changed ownership.[6] The bankers may thus use covenants as a means of circumventing costly information gathering about the new borrower, so attempting to alleviate the Winner's Curse problem ex post. For all these reasons, therefore, there may be greater incentives to emphasise the monitoring role of debt covenants in MBOs than in other forms of corporate lending. In addition, these incentives may be greater for UK MBOs than for US MBOs since vertical strip financing, which mitigates many of the agency problems discussed above, is less common in the UK than in the US.[7]

In addition, MBO lending is likely to provide a particularly fruitful context for studying the loan monitoring process, since lenders to MBOs are expected to place a strong emphasis on monitoring borrowers through close relationships. Smith and Warner (1979) argue that because contract renegotiation is less costly in private debt issues, covenant constraints will be set with less slack, so that technical defaults are more likely in private than public debt cases. This suggests that in the case of buyouts which go private and move from using public debt, there will be greater emphasis on the role of tight covenants. Moreover, the high degree of leverage in buyouts, and the typical links between the timing of predicated asset sales and exit and repayment of debt, emphasises the importance of close relationships between borrowers and lenders in order to ensure that such targets are met.

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[4] Evidence relating to the motivations of management in undertaking a buyout also emphasises their desire to control and develop their own business (e.g., Wright et al., 1992).

[5] It is also possible that MBO managers and advisers collude against the debt supplier to complete a transaction because advisers are typically remunerated largely through completion fees. However, countering this point is the argument concerning reputation effects, such that behaviour of this kind may result in the banks being reluctant to deal subsequently with the adviser.

[6] The interview data reported below show that it is highly unlikely, especially in the case of divestments, that the buyout will have been a customer of the bank in its own right prior to the MBO.

[7] See, for example, Thompson, Wright and Robbie (1992). It may be argued that close relationships between venture capitalists and a network of banks established to effect transactions, as is often the case, may go some way to mitigating agency cost problems. However, the point remains that ultimately there are potential conflicts of interest between venture capitalists and banks.

While the empirical literature to date has focused on the private/public debt dichotomy referred to above, Smith (1993) hypothesises that private syndicated debt will be more costly to renegotiate than a private bilateral agreement. This paper provides initial evidence on this issue by examining the views of syndicate members in contrast to those of sole lenders.

The main objective of this research, therefore, is to extend our understanding of the process of monitoring MBO lending, with special reference to the role loan covenants play. It aims to achieve this overall objective by examining in particular MBO lenders' perceptions of:

1. The extent of use of covenants (both accounting and non-accounting-based) in MBO loan agreements and in comparison with their use in general lending agreements.
2. The process whereby they monitor their lending arrangements, in particular as borrowers enter financial difficulties.
3. The effectiveness of accounting-based covenants as signals of impending distress.
4. Alternative responses to breaches of covenant and how the choice of response is influenced by the nature of the borrower/lender relationship.[8] Different types of borrower/lender relationship are characterised in the paper first by the presence or absence of a specialist MBO lending unit and, second, by comparing the views of sole lenders/syndicate leaders with those of syndicate members.
5. The ways in which banker/MBO relationships differ from those found in general corporate lending.

3. Recent trends in MBO/MBI lending

The financing of MBOs and MBIs is typically structured to reflect conceptually differing layers of risk-return trade-offs, such that if initial assumptions with respect to forecast cash flow, etc., hold, each of the different types of funds provider will achieve their expected rates of return. These finance layers may be provided in horizontal or vertical strips (Jensen, 1986). In the former, different institutions provide separate financial instruments. In the latter, different institutions will, pro rata to their total investment, provide a mix of financial instruments. The layers of finance range from straightforward equity at one extreme to senior debt secured on the assets of the business and/or expected cash flow at the other.

In between these two extremes, the difference between secured lending plus what equity providers and management are prepared to provide on the one hand and the purchase price on the other is met by mezzanine finance. This may embrace preference type shares and a spectrum of instruments from senior to junior mezzanine debt. The findings of this paper, however, relate to straight debt finance and not to mezzanine finance. This was not a source of confusion with respondents since, although it is not a legal concept (Sterling and Wright, 1991), mezzanine finance is a widely used term within the buyout lending sector and there is a common understanding among bankers as to what it means.

The trend in average financing structures of UK MBOs and MBIs is shown in Table 1. Average proportions of senior debt peaked in the buoyant conditions of 1989, subsequently declined during the recession of the early 1990s and began to rise again as market value recovered in the mid-1990s. It should be noted that although the leverage levels in MBIs are lower on average than for MBOs, the difference is not statistically significant.

Lending to MBOs and MBIs is typically secured by a legal charge. The buyout loan agreement will contain provisions regarding repayment of principal and details regarding interest, security arrangements and covenants (Sterling and Wright, 1991; Krieger, 1990). Essentially, covenants and security in the buyout sector are viewed as serving two distinct purposes.[9] Covenants are primarily viewed as a monitoring device once the decision to lend has been taken. They serve as a trigger alerting lenders that there are problems, and leading to the enforcement of security. The banker is likely to want an early signal of impending problems so that going concern value can be conserved, rather than waiting until the last minute and realising security. From the MBO managers' viewpoints, covenants can be seen as directing their attention to important dimensions of performance and provide a basis for discussing performance with the banker, which security does not. In extremis, security provides the means which enables the banks to take action to rectify a problem. It puts the bank in the driving seat rather than ranking them equally with all other creditors.[10]

4. Data and methodology

To gain an understanding of both the formal and informal dimensions of the borrower/lender

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[8] This extends previous research in this area, which investigates how the lender's decision varies either according to the cause of the breach (Citron, 1992a) or according to the borrower's financial health and the characteristics of the debt instrument (Chen and Wei, 1993).

[9] These points were confirmed by our interviews with lenders (see below).

[10] Citron (1995) provides evidence on conditions attached to public debt in large listed companies and shows that floating charges have an accounting covenant to trigger timely default, while those with fixed charges have covenants relating only to the value of the secured asset itself.

Table 1
Financing structures of MBOs and MBIs

Type of finance (average) (%)	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1989-1995*
1. Management buyouts								
Equity	18.8	26.5	26.1	34.7	31.3	32.0	26.7	27.4
Mezzanine	17.0	10.0	6.1	5.9	5.6	4.9	6.2	8.6
Debt	57.6	52.7	44.2	43.0	44.9	48.7	49.2	49.4
Loan note	3.4	7.0	10.4	2.7	9.3	5.8	7.9	6.2
Other finance	3.2	3.8	13.1	13.7	8.9	8.6	10.0	8.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample (£)	2,879	1,452	1,399	1,932	1,650	1,935	2,473	13,720
(Number)	114	125	99	117	121	138	133	847
2. Management buy-ins								
Equity	26.2	26.0	30.5	38.3	37.0	28.9	32.5	31.8
Mezzanine	12.0	8.2	15.3	9.3	6.8	3.3	7.3	7.8
Debt	51.3	34.1	47.3	46.7	47.9	40.7	49.3	46.2
Loan note	7.7	21.4	2.9	3.1	1.9	15.2	7.8	8.7
Other finance	2.8	10.3	4.0	2.6	6.4	11.9	3.1	5.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample (£m)	372	479	481	481	607	944	2,361	5,726
(Number)	54	42	42	41	42	71	101	393

Source: CMBOR/BZW Private Equity/Deloitte & Touche Corporate Finance

relationship, we use a survey questionnaire combined with selected follow-up interviews as being the most appropriate research tools for examining the perceptions of one of the parties in this relationship, the MBO lender, drawn from as large a population of lending institutions as possible (Kerlinger, 1986).[11] The survey questionnaire follows closely the methodology used by Citron (1992a) in relation to the attitudes of lending bankers to the use of accounting ratios in loan contracts. In particular, we adopt these approaches to overcome major difficulties relating to obtaining access to highly sensitive information, especially that relating to the actual operation of covenants. Given also that the respondents were senior executives in organisations that generally comprised a small number of individuals, and were involved in small numbers of transactions per year, the potential problems of relying on perceptions rather than actual documents should be minimised. It should also be borne in mind that we are dealing with a sector characterised by a high degree of interrelatedness between the various banks and among the executives themselves. Syndication is common, and executives with specialised skills move between specialist units of competing banks, suggesting a high degree of common understanding of terminology.

4.1. Survey Questionnaire

A draft questionnaire was piloted with a number of bankers, venture capitalists, accountants and academics. The questionnaire was predominantly structured, but also included open-ended sections to permit a freer expression of respondents' views. The questions were drafted with a view to investigating MBO lenders' perceptions of issues 1 to 4 set out at the end of Section 2 of this paper. The questionnaire dealt with issues concerning covenants under the principal headings of background data; extent of use of covenants and which specific ones are used; first indicators of distress, speed of learning about distress and which covenants are breached; what actions are taken once covenants are breached, and perceptions of the effectiveness of accounting-based covenants. It is recognised that the results do not provide direct evidence on actual cases of MBOs in default, but rather rely on respondents' views. The potential problems arising from memory and perceptions are of course common to all questionnaire-based research, but may be minimised here for the reasons outlined in the previous paragraph.

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[11] A copy of the questionnaire is available from the authors on request.

Following the piloting of the questionnaire, it was decided to frame the questions such that MBO and MBI-type deals were linked together. This is because banks operating in this market will tend to lend to both MBOs and MBIs. The banks with whom the questionnaire was piloted were consistent in their view that the setting of covenants is a second tier decision related to monitoring after the main decision whether or not to lend has been taken. Banks pay particular attention to the credibility of the management in an MBI, followed by assessment of the market position. Typically, banks reported that if they did not obtain satisfactory results during their due diligence process, they were more likely not to lend at all rather than lend either a reduced amount or under significantly different conditions. However, our subsequent interviews (see below) did reveal some difference between the banks in respect of the 'tightness' at which the covenants are set, and these are discussed at the end of Section 5.

The Centre for Management Buyout Research (CMBOR) database shows that 62 bank departments representing 58 bank groups participated in at least one buyout debt financing in the period 1989 to 1994. Mailing of the questionnaires to all these departments was undertaken in late November 1994, with a follow-up letter sent a month later.

We addressed the questionnaire to the heads of the relevant departments or other senior colleagues with whom CMBOR has regular contact through its buyout and buy-in surveys, in order to obtain organisation-wide perceptions of the process.[12] Discussions with senior executives involved in this form of lending indicated that banks had clear organisational policies on the approach to be adopted, so that the discretion of individual executives with respect to lending decisions would be extremely limited. Moreover, such specialised lending departments tend to be small (in our sample, more than three quarters had fewer than 10 executives) who would typically interact closely on a relatively small number of transactions per year. On this basis we were justified in addressing the questionnaire to only one person in the organisation.[13]

A total of 29 complete and usable replies were received, representing a response rate of 50% of the bank groups surveyed. A further six incomplete replies were received. Reasons for non-response concerned the paucity of new advances made over the previous three years, or problems in providing information in the required format. Analysis of the responding banks revealed that they covered a substantial proportion of the buyout senior debt market, with most of the principal and longest established buyout debt providers included. Tests were carried out on the representativeness of the sample, and on the basis of three demographic criteria for which comparative information was available, no significant differences could be identified. These involved the mean number of transactions, mean total transaction value and the nationality of the respondent and non-respondent banks. The mean number of transactions of respondent banks was 31.1 (standard deviation 63.2) and for non-respondents it was 28.8 (standard deviation 81.7), with there being no statistically significant difference ($t = -0.11$). The mean value of transactions was £937.1m for respondents and £861.4m for non-respondents, the differences again being not significant ($t = -0.17$).

A test was also carried out comparing the differences in nationality of the respondent and non-respondent banks. On the basis of dividing banks into UK, other EC and non-EC categories, no significant difference could be identified using a chi-square test (chi-square $= 0.025$). As a result of the small sample size, non-parametric tests have been used to test for significant relationships in the data. Face-to-face interviews were held with those banks that were unwilling to respond to the questionnaire but who were willing to discuss general issues relating to debt covenants; two of these were considered to be important participants in the buyout senior debt market.

Banks responding to the survey, or participating in the face-to-face interviews, accounted to 82.7% of the total number of senior debt buyout financings identified by CMBOR in the period 1989 to 1994. Respondent banks had made an average £101m of advances per bank over the previous three years and extended gross facilities totalling £3.7 bn. They had at the time of survey a total of about £2 bn outstanding on their buyout loan books.

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[12] The covering letter with the questionnaire specifically asked for an overall view. The letter said: '...In order to obtain an overall view of the monitoring, operation and triggering of covenants, ...[T]he enclosed questionnaire asks for senior debt providers' perceptions on key elements of their covenant writing and monitoring as well as on the circumstances most likely to surround a breach and the type of action taken when this occurs....'.

[13] This point is emphasised in respect of four cases where it was known that banks had two units devoted to buyout lendings. In each case, one of the units responded indicating that another unit in the bank was the appropriate respondent, with these other units providing completed questionnaires.

Analysis of respondents' job titles showed that they held senior positions of responsibility. Bearing in mind that terminology for the same job may differ between banks, the distribution of job titles was: seven directors, six heads of structured/acquisition finance, four senior managers, three assistant directors, two assistant general managers, one assistant vice president and six managers.

4.2. Follow-up Interviews

To explore the complex issue of relationships further, we attempted to recontact all the banks in the sample with specialist units. We succeeded in contacting 19 (86%) of the 22 respondents with specialist units. In the remaining three cases this was not possible as either they had ceased to participate in the buyout/buy-in market since the questionnaire survey, or we were simply unable to establish contact. In other cases, the person completing the questionnaire had left but we were able to interview their replacement. A separate follow-up checklist questionnaire was designed on the basis of issues emerging from the mail questionnaire survey. This instrument included issues concerning the rationale for establishing the specialist unit; questions concerning the differences between MBO/MBI versus corporate lending; differences, if any, between lending and covenant setting between MBOs and MBIs; the likelihood that MBOs/MBIs would have been clients prior to the transaction; whether the specialist unit continued to monitor the MBO/MBI after the transaction or whether it was passed on to a relationship manager; similar questions relating to the post-flotation relationship; and views about the longer-term relationship and issues concerning the relative importance of security versus covenants in MBOs (a copy of the checklist is available from the authors). Nine face-to-face interviews were conducted, lasting between one and two hours, and involving one or two of the authors in each case. In addition, interviews with 10 more of the respondents were conducted by telephone.

5. Results

In this section, we report the results of the questionnaire survey, together with material from the interviews where relevant. The findings from the interviews which focus on the nature of the bank/MBO relationship are contained in Section 6.

5.1. Covenants Used in MBO Lending Agreements.

Accounting-based covenants. Consistent with the expectation that MBO lenders exert a relatively high degree of control and monitoring over their customers, the great majority of respondents indicate a greater use of accounting-based covenants in MBOs than in their general lending. However, the contrast is greater when compared with plcs (93% of respondents making greater use in MBOs) than with private companies (61% making greater use).

Respondents also indicated that MBO lending is universally both secured and covenanted for all sizes of loan. As noted in the discussion of MBO lending above, for MBOs security and covenants are used to reinforce one another. In addition, virtually all MBO lenders (97%) indicate that term of loan is irrelevant as far as covenant decisions are concerned, consistent with the universal covenanting of MBO loan agreements.

These findings contrast with the incidence of accounting-based covenants in general bank lending, where a significant increase occurs in covenant use as loan size increases; also there is some evidence of less use of covenants in secured than in unsecured loans, suggesting that, in general lending, covenants and security are substitutes for one another (Citron, 1992a). In addition, term to maturity is strongly positively associated with the use of accounting-based covenants in the high credit quality UK public debt market, where the chief risk is that credit-worthiness may deteriorate at some future date (Citron, 1995). A sizeable minority (25%) of general bank lenders indicated the same positive relationship with term (Citron, 1992a).

MBO lending agreements contain on average both more and a greater variety of accounting-based covenants than do general bank lending agreements. Table 2 shows that respondents cited five accounting-based covenants that are each used in over 80% of lending agreements as finally negotiated. Three of these five are also widely used in general lending agreements—minimum net worth, profit-based interest cover and gearing (Citron, 1992b). However, MBO agreements generally contain two additional covenants not commonly found in other UK loan contracts—cash flow to total debt service and dividend restrictions. This appears to reflect the premium that lenders to MBOs place on short-term cash generation for reinvestment in the business and for the servicing of debt.

Sweeney (1994) suggests that 'tighter constraints in private bank agreements are expected (than in public debt agreements) if bankers have a comparative advantage in dealing with and helping managers deal with financial difficulties...' (p.290). This is because private agreements are less costly to renegotiate, since bankers typically have closer relationships with borrowers than do public debt holders. Similarly, because the relatively large number of accounting-based covenants in MBO lending agreements increase the likelihood of violation, our findings are consistent with MBO lend-

Table 2
Frequency with which respondents use various accounting-based covenants in MBO lending agreements

Covenant	*Frequency (%)*
Cash flow to total debt service	92
Dividend restriction	89
Minimum net worth	86
PBIT-based interest cover	83
Gearing	82
Cash flow-based interest cover	62
Other interest cover	44
Net current assets/borrowings	29
Proportion of good debtors below certain days outstanding	29
Current ratio	20
Quick asset ratio	17
Industry average margins	15

Note: Percentages are calculated by reference to the mid-points of the various response categories (0-5%, 6-35%, 36-65%, 66-95%, 96-100%); n = 29 respondents.

ers having a closer relationship than the general bank lender.

Non-accounting-based covenants. Smith and Warner (1979) classify covenants into four categories: production/investment; financing; dividend; and bonding. The first three groups seek to control management behaviour, while the purpose of bonding covenants is to reduce monitoring costs. However, previous research contains little systematic evidence on use of non-accounting covenants. Table 3 shows non-accounting covenants to be of major importance in MBO lending. We show that, in the view of respondents, as many as 10 non-accounting covenants are used almost universally (90% of time or more on average).

Most of the non-accounting covenants found in MBO agreements fall into three of Smith and Warner's categories (dividends are restricted by an accounting-based covenant). Two key bonding covenants requiring the supply of information are ranked first (audited accounts within specified period) and fourth (monthly management accounts within specified period). Almost universally-used controls over production/investment policy are charges over assets and restrictions on mergers, asset disposals and capital spending. Restrictions on additional borrowings is a widely used covenant seeking to control financial policy.

Thus non-accounting covenants play a vital role in MBO loan agreements, and central to these are covenants requiring the supply of accounting information. The large number of covenants seeking to control production and investment policy reflects the inherent difficulty of directly controlling this class of behaviour (Smith and Warner, 1979).

In summary, our findings confirm that MBO loan agreements contain a large number of both accounting-based and non-accounting-based covenants, including an emphasis on cash flow-based covenants.

5.2. Monitoring MBO Loan Agreements

As seen above, great reliance is placed on the buyout company supplying the bank with up-to-date accounting information, and in particular monthly management accounts. The vast majority of buyout companies (85.5% on average) submit monthly accounts within 30 days of the end of the month. The importance placed on the information contained in the audited annual accounts was seen in almost nine-tenths (89.2%) of the respondents sometimes asking for covenants to be certified by the client's auditor each year. Of those banks requesting such information, three-fifths (61%) of buyout covenants were certified in this way.

A critical issue in the identification of potential covenant breach is the frequency with which covenant monitoring is carried out and whether it mirrors the submission by buyout management of their monthly accounts. Responses indicate somewhat surprising differences in attitudes between banks (see Table 4). Only about two-fifths (39.3%) of respondents appear to monitor covenants on a monthly basis, that is, in line with the submission

Table 3
Frequency with which respondents use various non-accounting-based covenants in MBO lending areeements

Covenants	*Frequency (%)*
First charge over specified assets	98
Audited annual accounts within specified period	98
Cross default clauses	98
Monthly management accounts within specified period	97
Restrictions on changes in ownership	96
Restrictions on additional borrowings (from other sources)	96
Maintenance of adequate fire, theft and other insurances	96
Restrictions in mergers/acquisitions	92
Restrictions on asset disposals	91
No capital expenditure beyond certain limits without approval	90
Compliance with environmental laws and regulations	87
Compliance with other laws and regulations	84
No redemption of preference shares while loans outstanding	81
No undisclosed tax liabilities	78
Charges over keyman insurance	74
Keyman critical illness policy	49
Requirements for certain accounting policies	48
All banking to be transferred to bank within specified period	38
Restrictions on directors' remuneration	34
Restrictions on senior management's remuneration	28

Note: Percentages are calculated by reference to the mid-points of the various response categories (0-5%, 6-35%, 36-65%, 66-95%, 96-100%); n=29 respondents.

of management accounts. Almost a half (46.3%) do so on a quarterly or less frequent basis.[14]

5.3. *First Indicators of Financial Distress*

The way in which MBO lenders first become aware of impending problems was investigated by asking respondents to state how frequently a wide range of alternative information flows provided this first indication. This extends previous research that has focused predominantly on which accounting-based covenants are the first to be breached (Beneish and Press, 1993; Sweeney, 1994).[15]

As shown in Table 5, respondents rank accounting covenant breach only third in importance among initial indicators of distress (43% average likelihood).[16] The two most important sources are based not on contractual default, but on good banker/borrower communications—monthly management accounts (69%) and telephone communication from management (68%), as is the fourth, written communication from management (41%).

This result is confirmed by responses to the question: on average, how soon after a covenant is breached do you learn about the breach? To which the most frequent response was 'on warning given before'. While 62% of respondents acting as sole lenders or syndicate leaders (n=26) reported that they were given such prior warning 'almost always' or 'very frequently', only 15% said they received it only 'occasionally' or 'almost never'. The issue of whether bankers who are non-lead syndicate members receive less timely information than sole lenders/syndicate leaders was explored by asking for responses to the same question when acting as a syndicate member (n=21). As expected, there was some evidence that in this situation there was likely to be somewhat greater delay in detecting problems, with 19% indicating that they were given prior warning 'occasionally' or 'almost never', and only 48% receiving it 'almost always' or 'very frequently'. Using the Wilcoxon matched-pairs signed-ranks test to compare the responses of the 19 respondents who responded to both questions, they were found to be significantly different with $z=-1.69$ ($p=0.045$, one-tailed).

Non-accounting covenant breaches rank low as first indicators of difficulties (seventh; 25%) as expected, since these are predominantly negative covenants, i.e. covenants that proscribe certain actions, violation of which is relatively easily avoided simply by avoiding the proscribed actions (see

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[14] Banks may view the requirement to supply monthly accounts as imposing an important discipline on management to produce information.

[15] The Beneish and Press (1993) and Sweeney (1994) studies analyse instances of firms that actually breached accounting-based covenants in the 1980s.

[16] The percentages shown in Table 5 sum to more than 100, since it is possible that several factors may simultaneously be initial indicators of distress.

Table 4
Frequency of monitoring covenants

Average frequency with which covenants are monitored	*% of respondents monitoring with stated frequency (n=28)*
Monthly	39.3
Every second month	14.3
Every third month	32.1
Less frequently	14.3
Total	100.0

Healy and Palepu, 1990; Beneish and Press 1993; Sweeney, 1994).

5.4. Role of Accounting-based Covenants in Signalling Distress

This section examines lenders' views on the effectiveness of covenants at signalling difficulties and the relative frequency with which the various accounting-based covenants are breached.

Although communication from management is a more frequent first indicator of difficulties than actual covenant breach, it is possible that anticipated covenant breaches stimulate timely management communication. This issue is raised by Beneish and Press (1995b), who study cases of debt service default and bankruptcy that are not preceded by accounting-based covenant breaches. They conclude, however, that accounting-based covenants may not always provide warnings of future difficulties. The implications of this finding were explored further here by asking respondents open-ended questions about (a) their perceptions of the effectiveness of covenant breaches at signalling financial difficulties, and (b) circumstances in which borrowers may have entered financial difficulties without any accounting-based covenant breach.

Effectiveness of covenants as signals of difficulties. Of the 25 responses regarding the effectiveness of covenants, 11 banks considered that they were extremely effective, a further 13 that they were good indicators subject to certain qualifications, and only one respondent felt that they were not good indicators.

While covenants are thus perceived as effective in signalling financial problems, many respondents emphasised the importance of the relationship between the bank and the buyout customer in this process. Generally, financial information received for covenant monitoring could be seen as acting as a catalyst for discussions with management and, in particular, provides the discipline to force management to address issues that they might otherwise be inclined to avoid.

Table 5
First indicators of impending difficulties when sole lender or syndicate leader

Indicator	*Average frequency with which item is indicator (%)*
Monthly management accounts	69
Telephone communication from management	68
Breach of accounting covenants	43
Written communication from management	41
Overdraft levels	36
Notification from lead equity institution	28
Breach of non-accounting covenants	25
Failure to pay interest on due date	13
Failure to pay scheduled capital repayment	13
Audited annual accounts	13

Note: Percentages are calculated by reference to the mid-points of the various response categories. The banks were asked to report for each item the distribution of the frequency with which it was the first indicator (in the ranges 0-5%, 6-35%, 36-65%, 66-95%, 96-100%). There is also the possibility that several factors may simultaneously be the initial indicators of distress, and as such the sum of percentages for all the items is greater than 100.
n=25 respondents.

However, a number of banks stressed that with good regular monthly financial reporting, bankers should anyway be in a position to anticipate breaches of covenants. Thus the actual reporting process may be just as important, if not more so, than the covenants themselves. If banks have a close relationship with the customer and understanding of the business with regular dialogue, impending problems may be solved before covenants are themselves breached.[17] Covenants to trigger actions by the bank may only have to be used where this relationship is not as strong as it should be, or where management and their backers are running out of solutions. Indeed, one respondent stressed that it did not seek to use covenants to trip borrowers up, but as a means to provide input into the process by which financial performance deterioration is corrected.[18]

A further qualification on the effectiveness of covenants is their appropriateness at the time of the buyout and the influence of the passage of time since buyout. Covenants need to be set at a realistic level against the original management plan for the first few years. If assumptions in the original buyout proposal are unrealistic, or cash flow generation is inconsistent or soft, then problems are likely to arise. Additionally, the process of winning the bank mandate may have resulted in the negotiating out of certain covenants, which will decrease their overall effectiveness. While the lender's ideal position is to provide effective signalling of financial distress through covenants, this may have been eroded through competition from other banks and the influence of the equity institution.

Furthermore, with covenants sometimes originally being set on financial models looking forward five to 10 years, breaches may in fact be occasioned by changes in business which are planned and agreed by all parties some time after buyout. Banks need to take account of such changing circumstances.

Cases of financial distress without prior breach of an accounting-based covenant. To explore this issue, we asked respondents under what circumstances they had encountered such cases. Fourteen banks (almost half of all respondents) described such instances, covering a wide variety of situations. Responses covered several main types of situation, including managerial issues (e.g. managerial 'misbehaviour', sudden resignations, death/incapacity of a key manager, false accounting, unauthorised pension transfers), problems of both an operational and market nature encountered by the buyout company (e.g. regulatory changes, environmental problems[19], protracted disputes with customers, the loss of a major contract) and the nature of the original covenants which may not have covered certain financial eventualities (e.g. excessive stock build-up, the level of trade creditor liabilities, third party claims, off-balance sheet agreements).

Respondents were also asked to what extent breaches were avoided by creative accounting on management's part. Reassuringly, only one out of 26 respondents felt that this usually happens and none that it was almost always the case. Nevertheless, almost three-fifths (57.7%) felt that breaches were sometimes avoided by creative accounting on management's part. Quite apart from the possibility that MBO management may avoid such actions because of fear of the consequences of being caught, this finding also suggests the importance of informal monitoring relationships in reducing the incentive for managers to take such actions.

Accounting-based covenants most likely to be breached. Given the central role of accounting-based covenants in signalling distress, which of these covenants are the most likely to be breached? Table 6 shows that profit and cash flow-based covenants are, in the view of respondents, the most likely to be breached. The two balance sheet ratios (gearing and minimum net worth) rank fourth and fifth respectively.

Comparing the frequency with which a particular covenant is used with the likelihood of its being breached, the main discrepancy occurs with dividend restrictions that are almost universally present but rarely breached (see Table 6). This is in line with evidence that negative covenants, such as dividend restrictions, are unlikely to be breached (Beneish and Press, 1993; Smith, 1993). Once dividend restrictions are ignored, however, there is a highly significant positive correlation between respondents' rankings for inclusion in contracts, and the rankings for likelihood of being breached. The implications of this finding require further investigation, however. It could be that certain covenants are used frequently because they are effective indicators of distress. Alternatively, it

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[17] This point might suggest that trust is an important aspect of the relationship between bankers and MBO management. Detailed discussion of this point is beyond the scope of this paper, but fuller understanding of this issue would need to include analysis of the incentives to maintain or not maintain a situation of trust and the explicit and implicit contracts put in place in anticipation of breakdown in trust. We touch on the issue of trust in our summary of findings from the interviews, below.

[18] This, of course, only represents the bank's perspective and further research, which is beyond the scope of the present paper, might usefully be directed to ascertaining management's views on this issue.

[19] For instance, one bank reported problems resulting from the deregulation of the dairy industry, which led to a general increase in milk prices and gave supermarket retailers the option to contract directly with producers rather than being obliged, as formerly, to purchase through the Milk Marketing Board.

Table 6
Frequency of breaching various accounting-based covenants by firms that are in breach

Covenant	*Likelihood of breach*[1] *(%)*	*Likelihood of breach (Rank)*	*Average likelihood of inclusion*[2] *(%)*	*Average likelihood of inclusion (Rank)*
PBIT-based interest cover	47	1	83	4
Cash flow to total debt service	44	2	92	1
Cash flow-based interest cover	42	3	62	6
Gearing	30	4	82	5
Minimum net worth	26	5	86	3
Other interest cover	18	6	44	7
Proportion of good debtors below certain days outstanding	7	7	29	8=
Net current assets to borrowings	5	8	29	8=
Quick ratio	5	9	17	11
Current ratio	5	10	20	10
Dividend restriction	3	11	89	2

Notes: [1]Means of actual percentages stated by respondents; n = 25, 26 or 27.
[2]See Table 2.
The Spearman rank correlation coefficient is 0.88 (significant at the 0.01 level, one-tailed) when dividend restrictions are excluded, but only 0.49 (not quite significant at the 0.05 level) when they are included.

may be that certain covenants are frequently breached simply because they are used more frequently.

We shed further light on the relative effectiveness of various accounting-based covenants as signals of distress by comparing the results here for UK MBOs with two US studies on actual first-time covenant breaches not specifically in LBO situations (Beneish and Press, 1993; Sweeney, 1994). The two US studies are remarkably similar and both stand in contrast with this paper's findings.[20] They both find net worth and working capital to be breached most frequently. In contrast, UK MBOs are perceived most likely to breach three entirely different covenants—profit-based interest cover, cash flow to total debt service and/or cash flow-based interest cover. Working capital covenants are rarely used in the UK, so it is not surprising that they are rarely breached. However, the net worth covenant is widely used and it may underperform as an indicator of trouble, since three ratios that are used less frequently (cash flow-based interest cover, PBIT-based interest cover and gearing) trigger breaches more frequently. These findings require further research, since likelihood of breach is a function not only of how often a covenant is used, but also of how tightly it is set; this last point has not been investigated either here or in the US studies cited.

5.5. *Variety of Speed of Banker Reactions to Breaches of Covenant*

It is expected that close banker/customer relationships result in attempts to preserve a distressed borrower's long-term going concern value. This is because close monitoring and open lines of communication provide timely signals of impending problems, and possibly also because of the loyalty and commitment between the parties involved in relationship banking (Holland, 1994). This expectation was tested by asking respondents about the average likelihood of their adopting each of four progressively severe courses of action once they had learned about a breach of covenant—discussion with borrower/equity investor group; waiver of covenant breach; renegotiation of loan document; and recall of loan. In recognition of the fact that the negotiation process is often drawn out, respondents were asked what actions they would take both within six months and within two years of the breach. Finally, in order to explore the relationship issue further, the results were partitioned according to whether or not the respondent's bank had a specialist unit for MBO lending. The presence of a specialist unit is used here as a proxy for a closer customer relationship, as it is indicative of a commitment to MBO lending and

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[20] It is possible that differences between these results and those for the US may be influenced by the differing time periods of the studies, but the focus here is not on how frequently firms enter distress (which is influenced by macroeconomic factors at different times), but on the relative importance of different accounting covenant breaches.

Table 7
Time taken for various actions by banker after learning about breach of covenant

Action	*Within 6 months: Specialist unit (n=20) (%)*	*Within 6 months: No specialist unit (n=7) (%)*	*Within 6 months: Total (n=27) (%)*	*Within 2 yrs: Specialist unit (n=20) (%)*	*Within 2 yrs: No specialist unit (n=7) (%)*	*Within 2 yrs: Total (n=27) (%)*
Discussion with borrower/equity investor group	82	89.3	83.9	84.0	90.7	85.7
Waiver of covenant breach	66.2	47.1	61.2*	70.2	47.1	64.2*
Renegotiation of loan document	32.7	35.0	33.3	44.7	50.7	46.2
Recall of loan	3.9	5.7	4.4	10.7	24.3	14.2**

The percentages are means of actual percentages stated by respondents

*difference significant at 5% level (one-tailed)
**difference significant at 1% level (one-tailed)

of the availability of resources to monitor such loans.[21]

The evidence as shown in Table 7 suggests that, in the view of respondents, many breaches are relatively minor and can be dealt with through discussions with management rather than the more drastic measure of recalling the loan. The possibility for percentages reported to sum to more than 100 rests on the possibility of sequential actions during a two-year period because the position of an MBO may deteriorate progressively, so that a waiver may occur initially, followed by the subsequent more serious actions as the situation deteriorated. In over four-fifths (83.9%)[22] of cases there would be discussions with the borrower and equity investor groups within a six-month period, and in over three-fifths (61.2%) of cases overall there would be a relatively quick waiver of the covenant breach. Moreover, a significantly higher percentage of cases dealt with by specialist units (66.2%) are likely to have their breach waived within six months than those without specialist units (only 47.1%) ($z=-1.93$; $p=0.027$, one-tailed using the Mann-Whitney U test). This difference becomes more pronounced by the time two years have elapsed, by which time the percentage of waivers among specialist units is stated to increase to 70.2% while that among bankers without specialist units has not changed ($z=-2.21$; $p=0.014$, one-tailed).

Respondents perceive more detailed renegotiation of the loan document to take longer to achieve, being completed in one-third (33.3%) of cases within six months, although in only a half (46.2%) of cases is this course of action achieved within two years. Actual recall of the loan is stated to be very unlikely in the short term, and even in the two-year time framework only 14.2% of loans are likely to be recalled. However, the likelihood of recall within two years is perceived to be significantly higher among banks without specialist units (24.3%) than among those with specialist units (10.7%) ($z=-2.45$; $p=0.007$, one-tailed, using the Mann-Whitney U test).

Finally, in order to investigate the effectiveness of syndicates in dealing with covenant breaches, we asked the 22 respondents who act as non-lead syndicate members about the differences they perceived in the use of covenants between the position when they acted as a non-lead syndicate member and that as the deal leader or sole debt provider. Respondents indicated, on average, a 47%[23] expectation that there would be a longer delay in implementing action in response to covenant breach for non-lead syndicate members, and only a 12% likelihood that action would be implemented sooner. Applying the Wilcoxon matched-pairs signed-ranks test to the entire range of responses to these questions, the difference in responses is

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[21] The 22 banks with specialist units had made significantly more UK MBO advances in the last three years than the seven without such units (an average of 15 advances compared with 4.6; t-value = 3.26, $p=0.003$ two-tailed) and the total net value of these advances was significantly higher (£128.1m versus £20.9m; t-value = 3.82, $p=0.001$ two-tailed).

[22] The percentages in Table 6 are the means of the actual percentages cited by respondents.

[23] Calculated by reference to the mid-points of the various response categories (0-5%, 6-35%, 36-65%, 66-95%, 96-100%).

Table 8
Frequency of modifications to loan agreements in response to breach of accounting-based covenants - MBOs vs general private lending

Modification	*MBO lending (n=28) mean %*	*General private lending (n=33) mean %*
Dividend restrictions	75	63
Capital spending restrictions	65	61
Increased interest rate margin	54	47
Injection of new equity	46	–
Relaxation of accounting-based covenants	46	42
Merger and acquisition restrictions	39	–
Additional security	38	67
Issue of share options	25	–
Replacement of all or part of secured debt by mezzanine-type debt	22	–
Conversion of some debt into equity	20	–

Notes: **1.** The mean percentages have been calculated by reference to the mid-points of the various response categories (0-5%, 6-35%, 36-65%, 66-95%, 96-100%).
2. The results for general private lending have been derived from the data used to construct Table 4 in Citron (1992a).

found to be significant, with $z=-3.06$ ($p=0.001$, one-tailed). Regarding the effectiveness of action once taken, there was a 55% expectation that such action was less effective from the syndicate member's perspective, and only a significantly lower 14% likelihood that it would be more effective ($z=-3.29$; $p=0.001$, one-tailed).

In summary, therefore, the timing of responses to covenant breaches appears to indicate that banks take a flexible and perhaps pragmatic approach to the breach of covenants. Clearly in some cases covenant breach may be relatively minor and discussions will clarify the extent of financial problems and determine whether they are of a relatively temporary nature. In more problematical cases it takes longer to arrive at a decision to renegotiate the loan arrangements and documentation, or possibly to recall the loan.

There is also evidence that banks with specialist MBO units are more likely to waive covenant breaches and less likely to recall loans. To the extent that the presence of a specialist unit is a valid proxy for relationship banking, these findings confirm expectations that close relationships are conducive to preserving the going concern value of borrowers in distress. Moreover syndicate members, who have a less close relationship with borrowers than either sole lenders or syndicate leaders, indicate that responses to covenant breaches are slower and less effective.

5.6. Renegotiation of Loan Agreement Subsequent to Covenant Breach

Virtually one-half of MBO covenant breaches result in the loan agreement being renegotiated within two years of the breach (Table 7). As shown in Table 8, the most frequent modifications cited by respondents are dividend and capital spending restrictions. These are aimed at preserving the borrower's asset levels and, in the case of dividend restrictions, at enhancing the bank's position vis-a-vis that of the equity providers, who in MBOs are typically likely to use various quasi-equity instruments with cumulative dividend rights.

MBO lenders tended not to rate the taking of additional security highly, which contrasts with findings on contract renegotiations in a general lending context where additional security is the most frequently cited modification (Citron, 1992a). This probably reflects the high degree of security taken in MBO lending when the loan is first made, and hence there may be little scope for taking more.

Banks appeared to be reluctant to enter into major restructuring options through reclassification of the debt. Thus the conversion of some debt into equity and the replacement of all or part of secured debt by mezzanine type debt was not scored highly.[24] It was also very unlikely that share options would be issued to enhance the bank's potential position. Surprisingly, the injection of new equity has a less than 50% likelihood of occurrence.

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[24] There is some incidence of this kind of restructuring, no-

6. Interview evidence

6.1. The Nature of the Bank/MBO Relationship

The preceding analysis of the operation of covenants strongly suggests the existence of close bank/MBO relationships rather than their mechanistic application. By the same token, covenants (and security) provide a 'hard' constraint, providing scope for action should relationships break down. The 19 interviews with specialist MBO lending units were conducted to obtain deeper insights into the extent and nature of the relationships between banks and MBOs.

The banks perceived themselves to be involved in two sets of relationships: one with management in MBOs and one with venture capital firms and intermediaries. Specialist units were established to address both these relationships in order to provide a focus for the very different skills required to structure and monitor buyouts from other forms of corporate lending. Being a lead provider was reported to be crucial to the development of a relationship with MBO clients, as all primary contacts are channelled through the lead (agent) bank. To be perceived by venture capital firms as a serious lead provider of debt for MBOs, banks had to have a specialist unit.

In general, bank/customer relationships can involve a number of dimensions: the existence of trust and confidence between banker and management; a two-way exchange of influence as well as finance; the longevity of the relationship; and the provision by the bank of additional services to the company. The overall finding from our interviews is that, while the ways in which these dimensions develop differ as between MBO and general corporate lenders, there also exist important differences among specialist MBO lenders themselves.

With regard to longevity of relationship, it is important to distinguish between the relationship between the specialist unit and the MBO, and the relationship between the bank as a whole and the MBO. First, it was unlikely that the MBO company would have been a client prior to the MBO. This was partly because many of the banks in the market are not clearers, and partly because the clearers themselves would tend to have a relationship with the parent company rather than with the subsidiary being divested as an MBO. The second stage in the length of the relationship relates to the situation subsequent to completion of the MBO deal. Fourteen of our 19 interviewees reported that after negotiating the transaction it remained in the specialist unit, at least until flotation or other exit. The remaining five banks passed the MBO company to a relationship manager in the branch network and kept either a shadowing role or no effective role in further monitoring. These five banks involved the main London and Scottish-based clearing banks, although in one clearing bank the MBO was kept within the specialist unit.

The principal argument for retaining the MBO with the specialist unit was the expertise that had been built up about the company during the MBO completion process. As a result, the specialist units saw themselves as being more able than a general relationship manager to provide a speedy and efficient response if and when problems began to emerge. In addition, the non-clearers with specialist units, and especially the non-UK banks, saw MBOs as a part of a long-term strategy to develop their corporate client book, one interviewee referring to the specialist unit as the 'nursery'.

In those cases where the MBO was passed on to a general relationship manager, we found significant variation in the timing of the handover and in the post-handover role of the specialist unit. The handover to this manager could be either quite soon after the buyout, or delayed for several months or even years depending, for example, on whether the company had de-leveraged so that there would be no expectation of covenant breaches. Some banks would involve the eventual relationship manager from the outset so that he would be able to establish an early relationship, while in other cases the relationship managers were introduced at a late stage.

The post-handover shadowing role also varied from simply maintaining informal contact, through receiving the same regular accounting information, being consulted by the bank's credit committee on whether covenant breaches should be waived, to becoming directly involved if the company needed restructuring or to make acquisitions. It was thus clear that the relationship was viewed from an overall bank perspective, with the specific tasks required to service the relationship being segmented between different departments.

The banks retaining the company in the specialist unit after MBO would almost always seek to pass it on to a relationship manager after flotation, since the company's characteristics would have changed significantly by this point. The picture was complicated by the common practice of companies putting their core banking requirements out to tender at the time of obtaining a stock market listing.

The MBO specialist units reported considerably greater interchange of information than in general corporate lending, both at the pre-lending stage

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tably in the case of Isosceles (Gateway Stores), the largest buyout in the UK. In 1993, £923m of debt was restructured into £256m bank loans, £400m deep discount bonds and £267m preference shares (Wright et al., 1995).

and in post-lending monitoring. Pre-lending, the bank would have greater access to all senior management in MBOs, whereas for corporate lending they would be more likely to deal solely with the finance director and have access only to public information. After completion, MBO lenders typically obtain monthly management accounts, including a sheet summarising the position on all covenants, and are likely to at least discuss these by telephone. Meetings may take place monthly but are more likely to be quarterly, twice yearly or ad hoc if there are specific issues to address. There is thus considerable flexibility as regards contacts, since the banks consider that if a good relationship has been built at the time of the deal completion, the MBO manager will be proactive in contacting the bank as required.

Where the MBO is passed on to the relationship manager and the specialist unit continues with a shadowing role, the latter is likely to receive the same information at least for one or two years. The specialist unit will typically undertake its own analysis and discuss the results with the relationship manager, and possibly hold meetings involving all three parties. In such cases, the specialist unit may need to invest considerable effort in managing internal relationships with the bank's own relationship managers. It is important to note that meetings and reporting will be driven by the lead bank in syndicates. Hence there are greater opportunities for lead banks to establish closer relationships, although syndicate members can arrange their own visits.

In contrast to MBOs, monitoring of general corporate lending is likely to involve less frequent information, fewer meetings and greater difficulty in cross-selling other products, as such clients can select the lowest price provision from their panel of banks. Banks lending to MBOs will often attempt to provide other services such as overdrafts, forex, mergers and acquisitions, particularly as this enables them to have a fuller picture of the MBO's performance and so improves their monitoring capability. It should be noted, however, that syndicate members may be in a weak position to sell other products, as these can often be placed only with the syndicate leader. The non-clearers especially reported that they will attempt to cross-sell products to strengthen the relationship during the MBO phase. This may put them in a more favourable position to continue the relationship as one of the company's panel of banks when the MBO floats, albeit through the bank's corporate finance division and not via the specialist unit itself.

Banks retaining MBOs in their specialist units after completion appeared to learn about problems no quicker than those who passed MBOs on to relationship managers. Covenants tended to be reviewed every one to three months whether the banks retained the MBO in their specialist unit or not, though there was a slight tendency for the former to do so more frequently.

A possible alternative mechanism to the relationship role of specialist units for controlling potential conflicts with MBO borrowers is the maturity of MBO loans. The mail questionnaire survey shows, however, that for 97% of the sample the inclusion of accounting-based covenants is not affected by the term of the loan. MBOs were reported in the interviews to involve loans with a longer notional maturity (seven to eight years) than for general corporate lending (up to five years), with the former tending to pay this down in a much shorter period (typically within two years), while the latter renegotiate the finance on a continuing basis. Moreover, the banks did not report a distinction in the nature of their MBO relationships as a result of any differences in loan maturities that do exist.

6.2. MBO vs MBI Lending

As discussed earlier, banks report no difference in the types of debt covenants used in MBOs versus MBIs. However, the interviews revealed some difference between the banks in respect of the 'tightness' at which the covenants are set. Some banks set the tightness of MBI covenants as for MBOs, on the basis that they would generally not lend to cases where they had concerns, or occasionally where they had been more conservative in their MBO lending. Others, by far the minority, either took the view that they should set the covenants a little tighter and monitor the MBIs more closely for a short period until they were convinced that the company was progressing satisfactorily or, by way of contrast, that MBIs should have more headroom in the setting of covenants to allow the company's performance to fluctuate by a greater amount while it was effecting restructuring, without needlessly triggering covenant breaches.

7. Summary and conclusions

This paper examines MBO lenders' perceptions of the role and effectiveness of covenants in the wider context of the loan monitoring process and, in particular, as their customers enter financial difficulties. The findings are based on lenders' views expressed via a questionnaire survey and interviews, and therefore do not necessarily reflect how they actually do react in particular cases in practice. However, the process of negotiating a loan agreement, monitoring subsequent performance and dealing with breaches of covenant are an integral part of the lender/borrower relationship, and the findings of this study are of value as reflecting the views of one of the partners in this relationship.

A key group of findings relates to the existence of close relationships between MBO lenders and their customers as evidenced by the extensive use of both accounting-based and non-accounting-based covenants, and the widely expressed view that impending distress is frequently communicated early, in advance of actual loan default. Once covenants are breached, discussions are stated to ensue quickly and virtually universally. Waiver, which occurs in almost two-thirds of cases, is also perceived to occur relatively quickly, but loan renegotiation or, less frequently, recall, take longer to resolve.

The paper probes the influence of banking relationships further, using the presence of a specialist MBO lending unit as a proxy for closeness of relationship. As expected, lenders with such units state that they are both more likely to waive covenant breaches and less likely to recall loans in default.

Syndicate members indicate that, compared with sole lenders or syndicate leaders, they are less likely to be informed of covenant breaches prior to their occurring, and that subsequent corrective action is likely to both take longer to implement and be less effective. These findings confirm expectations that, from a syndicate member's perspective, resolving default may have more in common with public debt than one-to-one private debt.

While MBO lenders proclaim the effectiveness of accounting-based covenants, initial evidence was obtained on the important issue of instances in which such covenants have failed to signal distress. These included either cases where distress was caused by factors not encompassed by accounting measures (e.g. management problems) or poorly set covenants.

Interviews with specialist MBO lending units shed light on specific features of the bank/MBO relationship. While these relationships exhibit high degrees of trust and two-way information exchange, they do not necessarily also find expression in longevity of association. Practice in this respect varies widely. The strong relationship that uniformly exists around the time of completing the deal is unlikely to have been present prior to the buyout, but there is a diversity of experience as to whether it continues post-completion or even post-exit.

This investigation into the process of monitoring MBOs and resolving loan default, and of the nature of the bank/MBO relationship, raises important issues for further research. The finding that the frequency with which accounting-based covenants are breached is positively related to their use leaves open the question of how effective covenants are at signalling distress on a timely basis. This question is reinforced by the preliminary findings reported here of cases where financial difficulties have occurred without covenants being breached.

In addition, it would be of interest to develop more powerful measures of banking relationships than those used here, to better investigate their costs and benefits. Further research might involve: a detailed examination of the management of the individual elements of banks' portfolios; a survey of both the bank and management parties to an MBO; a large-scale survey of MBOs/MBIs; or a second survey of the banks involved in MBOs/MBIs.

The finding that management accounts are often monitored less frequently than they are submitted requires further investigation, in particular regarding the actual role of accounting-based covenants and periodical accounting reports to bankers. For example, do bankers see the regular provision of accounts as an important discipline on management, is the frequency of detailed scrutiny related to the age of the relationship and the establishment of a sound track record, etc.?

The evidence presented in this paper is consistent with Holland's view that, although agency theory provides a useful lens through which to view bank-corporate relationships, further development is required. While the survey suggests that covenants are important contractual monitoring devices, evidence from the interviews emphasises that relationships between banks and MBOs are a highly important aspect of the operation of covenants. This is not to suggest that relationships replace covenants, since ultimate sanctions are necessary where relationships break down or where relationships are insufficient to deal with problems, such as when bankruptcy is the appropriate course of action. Further examination of the link between agency theory and relationships appears to be an interesting and potentially important area for further research.

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Lancaster University
Management School
Lancaster University
Lancaster
LA1 4ER

D.Otley@lancaster.ac.uk
Phone 01524 593632
Fax 01524 847321

Doctoral Colloquium:

Professor Tony Berry
School of Financial
Studies and Law
Sheffield Hallam University
Pond Street
Sheffield
S1 1WB
A.J.Berry@shu.acuk
0114 253 3671
0114 253 3726

Registration:

Dr Derek Purdy
Dept. of Economics
University of Reading
Reading
Berks.
RG6 6AA

D.E.Purdy@rdg.ac.uk
0118 931 8229
0118 931 6305

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The Effects of Outside Directors and Board Shareholdings on the Relation Between Chief Executive Compensation and Firm Performance

Leslie Kren and Jeffrey L. Kerr*

Abstract—Critics of corporate governance have suggested that improvements in board monitoring will arise from more independent boards consisting of outside directors and from increased stock ownership by directors. Presumably these changes should result in more rational, more defensible compensation decisions in which pay is clearly tied to results. In this paper, we test the premise that boards with a relatively higher proportion of outsiders and boards with significant shareholdings maintain a closer link between corporate performance and executive pay than do boards with fewer outsiders and boards holding little stock. The results of the study, based on a sample of 268 large corporations, are mixed. As expected, boards with significant shareholdings maintain a stronger linkage between compensation and firm-level performance. This finding persists even after controls are included for CEO and outsider shareholdings. Contrary to expectations, however, evidence was not found that firms with a higher proportion of outsiders on the board of directors relate compensation more strongly to firm results.

1. Introduction

The current debate over chief executive compensation has drawn critical attention to the governance role of the board of directors. Instances of mediocre corporate performance followed by what appear to be extraordinary compensation awards have led to charges that boards are unable or unwilling to constrain management or to exert control in the interests of shareholders (Crystal, 1988; Fierman, 1990; Geneen, 1984; Reingold, 1997). Such charges have led to calls for more independent boards consisting of outside directors who are not managers of the corporation (American Law Institute, 1982; Patton and Baker, 1987). There have also been calls for greater stock ownership by directors, presumably to increase their commitment to the corporation and their identification with shareholder interests (Herman, 1981; Roe, 1992).

The logic underlying these demands appears to rest on the assumption that executive compensation disparities are a function of boards' inability or unwillingness to monitor managerial performance. According to this reasoning, improvements in board monitoring should result in more rational, more defensible compensation decisions in which pay is clearly tied to results. Since inside directors are viewed as dependent on the chief executive, board monitoring is likely to be improved by seating independent, objective outsiders (Fama, 1980). Similarly, board shareholdings are believed to provide an incentive to directors to 'act like owners' in terms of the rigour of their monitoring efforts (Morck, Shleifer and Vishny, 1988; Roe, 1992). Thus, outside directors and directors with a stake in the corporation should engage in more rigorous monitoring than insiders or directors with no holdings, which in turn should result in a closer association between corporate performance and chief executive compensation.

Despite the popular appeal of these arguments, few studies have investigated the extent to which outside directors or board stock ownership are associated with a stronger relationship between management performance and pay. The paucity of empirical research becomes increasingly problematic as regulators focus on these variables as methods of governance reform. In this paper, we examine the effects of board characteristics on a

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*The authors are, respectively, at the University of Wisconsin, Milwaukee, and the University of Miami. Correspondence should be addressed to Professor Kren, School of Business, University of Wisconsin, Bolton Hall, P.O. Box 742, Milwaukee, Wisconsin 53201, USA; lkren@csd.uwm.edu. This paper was submitted in October 1994 and accepted in May 1997.

critical aspect of monitoring, the relationship between short-term corporate performance and chief executive (CEO) compensation. Following a review of the empirical literature, we test the premise held by governance critics that boards with a relatively higher proportion of outsiders and boards with significant shareholdings maintain a closer link between short-term corporate performance and CEO pay than do boards with fewer outsiders and boards holding little stock.

The study's results are mixed. As expected, boards with significant shareholdings were more likely than others to link CEO compensation to firm results. These findings persist even after controls are included in the analysis for CEO and outsider shareholdings. Contrary to expectations, however, the findings do not indicate that firms with a higher proportion of outsiders on the board relate compensation more strongly to firm performance.

2. Board characteristics and monitoring

Monitoring managerial performance is considered to be among the most fundamental of board duties (Bacon, 1975; Waldo, 1985). As Weisbach (1988:431) notes, the board serves as shareholders' 'first line of defence' against incompetent or abusive managers. In its monitoring role, the board is expected to advise management on major decisions, to evaluate and reward management's effort and results, and, when necessary, to replace ineffective managers with better ones.

Despite the criticisms noted above, theorists have argued that the board monitoring mechanism works reasonably well (Fama and Jensen, 1983; Jensen, 1986). Research on chief executive turnover suggests that boards can and do remove top managers for poor performance (Coughlin and Schmidt, 1985; Morck, Shleifer and Vishny, 1988; Warner, Watts and Wruck, 1988; Weisbach, 1988). Evidence from compensation studies indicates that boards are also capable of incorporating subtle and complex information into their assessments of top management (Antle and Smith, 1986; Gibbons and Murphy, 1990; Kerr and Kran, 1992).

Observers have also noted that the responsibility for monitoring management performance does not fall equally on all directors (Fama, 1980; Fama and Jensen, 1983). In fact, there is empirical support for the idea that inside and outside directors vary in their monitoring roles and practices. Weisbach (1988) found that boards with a high proportion of outsiders (high outsider boards) were more likely to dismiss CEOs following poor firm performance. Kaplan and Reishus (1990) found that top managers of high-performing firms were more likely to obtain outside directorships on other boards than were managers of low-performing firms. Consistent with the notion that outsiders are used as monitors, they suggest that high-performing managers are preferred because they are perceived as providing better monitoring capability.

The argument for the monitoring effect of outside directors rests on the popular perception that outside directors are independent of the hierarchical and political influences that tend to affect insiders and thus are free to base CEO compensation on objective measures of performance. The assumption underlying this argument appears to be that objective (i.e. unbiased) evaluation and compensation of chief executives should result in a close link between performance and the various components of executive compensation; obvious disparities are therefore attributable to political and economic self-interest on the part of directors. Despite its intuitive appeal, however, this argument is weakened by the fact that outside directors frequently have their own incentives and dependencies which, though perhaps different in form from those of insiders, can compromise their assumed objectivity. Individual directors may derive significant psychic rewards from their board memberships in the form of status and social connections. In addition, these positions can provide lucrative primary sources of income for 'professional' directors who hold multiple board memberships.

The popular logic for a board ownership effect is equally straightforward. Observers of governance practices have argued that the greater the board's shareholding, the greater is its incentive to insure that management is maximising performance outcomes; therefore, the more likely the board is to base management's compensation on outcomes. The argument, however, does not take into account the possibility that stock ownership, while providing an incentive for more rigorous control of management, does not in itself imply a particular form of control or monitoring. The board's increased control efforts may take the form of monitoring managerial behaviours rather than outcomes. Thus, to the extent that behaviour monitoring and outcome monitoring are substitute control mechanisms, rigorous behaviour monitoring may result in a weak relationship between performance outcomes and compensation.

Empirical studies of this issue have produced mixed results. Morck, Shleifer and Vishny (1988) argued that outside board members are more likely to monitor management rigorously if they hold an equity stake in the corporation. They found evidence of a significant relationship between board stock ownership and the firm's stock market performance. They concluded that convergence between shareholder and board interests (resulting in better monitoring) contributed positively to shareholder wealth.

Weisbach (1988), on the other hand, studied the relationship between board composition, board stock ownership, and the use of outcome-based control. As expected, he found insider boards to hold significantly more stock on average than outsiders. Yet in subsequent analyses, he was unable to reach a clear conclusion regarding the role of stock ownership in the use of outcome controls; he suggests, however, that it is board composition (i.e. the proportions of insiders versus outsiders) that determines the relationship between performance and compensation, not ownership. Thus, despite calls for regulation of these aspects of board structure, there is currently little clear evidence regarding the extent to which outsider dominance and board stock ownership influence the relationship between firm performance and executive compensation.

3. Methodology

3.1. Sample

The 1987 and 1989 *Fortune* listings for the 500 industrials, 50 transportation, 50 retail and 100 diversified services was used as the basis for the sample. Two different observation years were included to avoid period-specific effects. Firms for which required financial information (described below) was unavailable from the Compustat database were eliminated from these listings (248 firms from 1987 and 258 firms from 1989). From the remaining firms, a random sample was drawn of 139 firms from 1987 listings and 203 *different* firms from the 1989 listings. Firms were then eliminated if their proxy statements disclosed a CEO change (28 in 1987 and 38 in 1989) or a significant merger or acquisition (four in 1987 and four in 1989).[1]

The final sample contained 268 firms: 107 from 1987 and 161 from 1989.[2] A wide variety of industries were represented in the sample, including 43 different 2-digit SIC codes. As a rough check on size differences, mean sales for the sample firms were compared to 2-digit SIC industry mean sales from all other Compustat firms using a two-sample t-test. For 136 firms, sample mean sales were larger than industry mean sales ($p<0.05$). Thus, not unexpectedly, the sample is biased toward larger firms. However, there seems no a priori reason to expect that this would bias the results or limit their generalisability.

3.2. Measures of CEO Compensation

Total executive compensation may include cash, stock options, long-term compensation such as performance plans and restricted stock plans, assorted benefits such as pension plans, and changes in the value of firm-related claims. Three components of pay were included in the compensation measure used in this study: (1) cash compensation, including salary and bonus; (2) cash compensation plus current stock option awards; and (3) changes in the value of CEO shareholdings. All compensation measures were adjusted to constant 1990 dollars using the year-end consumer price index.

For the second measure of compensation, two different valuation methods for executive stock options were employed: the Black-Scholes option pricing model and a heuristic valuation, defined as the spread between the stock price at the end of the year and the exercise price (Benston, 1985; Lewellen et al., 1987). The Black-Scholes model probably overstates executive stock option value because important assumptions of the model are not valid for executive stock options (Noreen and Wolfson, 1981). Specifically, unlike marketable warrants, executive stock options are not transferable (they are contingent on employment), and the model's assumption of a constant variance for stock price can be readily violated through managers' actions (Lambert and Larcker, 1985).[3] In contrast to the Black-Scholes model, the heuristic valuation probably understates option value because it assumes that options have no value unless the market price of the underlying stock exceeds the exercise price of the option. As a practical matter, the Black-Scholes and heuristic valuations were highly correlated in this sample ($r=0.70$, $p<0$); thus, only the results for the Black-Scholes model are reported.

The third compensation measure—changes in the value of CEO shareholdings—was estimated by multiplying the year-end closing stock price by the number of shares held by the CEO. The stock price was obtained from Compustat, and shareholdings were obtained from the proxy statement. This last measure also included the value of previously granted stock options.

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[1] Firms with a CEO change were eliminated because a newly-hired CEO may be able to negotiate initial contract terms that differ from those of the predecessor CEO, and contract terms of the outgoing CEO may be altered by termination benefits (Coughlin and Schmidt, 1985). Mergers and acquisitions were eliminated because these can cause significant disruptions in firm activities.

[2] Since the same firm does not appear in both years, there is no reason to expect that pooling the two observation years will cause cross-sectional dependence in the compensation measures.

[3] Jennergren and Naslund (1993) recommend adjusting the Black-Scholes model to value executive stock options because they have stochastic lives, remaining valid only for as long as the executive remains with the issuing firm. Foster et al. (1993), however, argue that the magnitude of the Jennergren-Naslund adjustment is difficult to estimate and is likely to be unique to each executive. Foster et al. also find that the adjustment has little effect on option valuation unless the probability of the executive's departure is very high. In contrast to Jennergren and Naslund, Lambert et al. (1991) argue that option pricing models, in general, may seriously overvalue executive stock options because they fail to incorporate managerial risk preferences. The net effect of these factors for our sample is unknown.

The change in the logarithm of each compensation measure was used in subsequent regression analysis, as follows:

$$\Delta \ln(\text{compensation}) = \ln(\text{Compensation}_{t+1}) - \ln(\text{Compensation}_t)$$

This was done for three reasons. First, the growth rate in compensation is more readily comparable to rates-of-return measures used to evaluate firm performance (described below). Second, these measures are comparable to measures in previous empirical research (e.g. Antle and Smith, 1986; Gibbons and Murphy, 1990). Third, these measures avoid the potential misspecification problems arising from using absolute compensation levels (Baker, Jensen and Murphy, 1988; Murphy, 1985). Murphy (1985), for example, argues that first-differences are useful to control for firm-specific factors, such as technology, individual manager differences and size.

3.3. Measures of Firm Performance

It is not clear which firm performance measures are used by firms to evaluate a particular CEO's performance (skill and effort). Both accounting-based and stock market-based measures of firm performance have well-known conceptual weaknesses as measures of CEO performance. Return on common stock reflects the present value of future cash flows but, because it is also sensitive to numerous factors beyond the CEO's control, may be an inadequate indicator of CEO performance (Jensen and Murphy, 1990). On the other hand, accounting measures are subject to management manipulation and may not correlate well with firm value (Lubatkin and Shrieves, 1986). Nonetheless, both accounting and stock market results frequently appear explicitly in proxy statements, are widely reported as measures of firm performance, and have been used commonly in previous research; thus, both measures were used in this study. The accounting-based measure used in this study was return on assets (ROA), defined as income before tax, extraordinary items and discontinued operations divided by average total assets. ROA is also highly correlated with other accounting measures, such as return on equity (Antle and Smith, 1986). The stock market-based performance measure used in this study was return on common stock (RET), defined as the sum of closing stock price plus dividends, divided by the closing stock price in the previous fiscal year (adjusted for splits and dividends).

Both ROA and RET were measured relative to industry: mean industry RET and ROA for all other firms listed on Compustat in the same two-digit SIC industry, as each sample firm was subtracted from the sample firm's RET and ROA. This was done to control for industry effects, since economic theory and empirical evidence suggest that performance evaluation relative to industry is efficient (Antle and Smith, 1986; Gibbons and Murphy, 1990; Kerr and Kren, 1992).[4]

3.4. Measures of the Proportion of Outsiders on the Board and Board Ownership

Data on board-of-director characteristics were gathered directly from corporate proxy statements. Following Weisbach (1988), full-time employee-managers of the firm were designated as insiders. Directors who had family relations with employee directors or had significant financial relationships with the firm were designated as 'grays'. The latter category included attorneys who provided legal services to the firm, consultants and investment bankers. The remaining non-employee directors were designated as outsiders. The proportion of outsiders on the board was defined as one minus the number of inside directors divided by total number of board members. Table 1 shows the distribution of the proportion of outsiders (OUT). The mean (median) of the distribution is 60.4% (61.5%). This is consistent with other recent studies (e.g., Kerr and Kren, 1992; Rosenstein and Wyatt, 1990).

Stock ownership by the board (BSTK) was measured as the proportion of the firm's market value owned by board members (not including the CEO). Table 2 shows the distribution of BSTK for the sample firms. The mean (median) of this distribution was 6.1% (1.9%).

In subsequent regression analyses, both board characteristics were included as continuous variables. However, substantial previous research has measured these board characteristics as indicator variables. This has been done because it is difficult to specify a theoretical rational for the point at which a greater proportion of outsiders or the board's financial stake in the company will motivate board members to more closely monitor management. Board monitoring has been presumed to be related to a threshold level of outsiders or stock ownership. As a check on the validity of our results, we replicated the subsequent analysis using indicator variables for both board characteristics. An indicator variable for OUT was developed using a median split, and BSTK was designated 1 if it exceeded 5% of total firm value, and 0 otherwise (Agrawal and Mandelker, 1990; Morck et al., 1988). The results using these alternate measures were consistent with those reported in the paper.

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[4] We also replicated the analyses using absolute common stock return and ROA with essentially the same results as those reported in the paper.

Table 1
Frequency distribution of the proportion of outside directors on the boards of the sample firms*

Proportion of outside directors	*Number of firms*	*% of sample*
Outsiders < 10%	2	0.8
10% < outsiders ≤ 20%	0	0
20% < outsiders ≤ 30%	2	0.8
30% < outsiders ≤ 40%	22	8.2
40% < outsiders ≤ 50%	32	11.9
50% < outsiders ≤ 60%	67	25.0
60% < outsiders ≤ 70%	81	30.2
70% < outsiders ≤ 80%	57	21.2
Outsiders > 80%	5	1.9
Total	268	100.0

*Outsiders are defined as board members who are not current or former managers of the firm and have no family or significant financial relations with management

4. Results

4.1. Preliminary Analysis

Table 3 shows distribution statistics and correlations for the measured variables. For all three compensation measures, the table includes both the absolute amount and the growth rate ($\Delta\ln$). As noted in previous research, CEO shareholdings represent a larger stake in the firm than annual salary (Benston, 1985).

The last two variables in Table 3 are cash bonus as a proportion of cash compensation, and stock options as a proportion of cash compensation. These two variables proxy for the degree that CEO compensation is tied to results.

No significant bivariate relation was present between either RET or ROA, and OUT or BSTK. RET and ROA were significantly positively related to both the absolute amount of cash compensation and the growth rate of cash compensation. There was no significant bivariate relation between the other two compensation measures, and either RET or ROA. Accounting results were strongly related to the incidence of cash bonus, as shown by the positive relation between the proportion of cash bonus and ROA. The same relation was present with RET but was only marginally significant ($p<0.10$).

Firm size (market value of equity) was also statistically unrelated to OUT or BSTK, although there was a marginally significant ($p<0.10$) negative relation between size and BSTK. This suggests that size differences may be important in subsequent analysis. As mentioned above, however, firm-specific factors, such as size, are implicitly controlled using first differences in compensation.[5] There is also a significant relation between size and absolute levels of cash compensation, but no statistical relation betwen size and $\Delta\ln$(cash compensation). There was a significant relation between size and both absolute levels of cash + options and $\Delta\ln$(cash + options), but the latter relation was much smaller than the former.

OUT was negatively related to BSTK ($p<0.01$). This may indicate that board ownership and outsiders on the board were substitute control mechanisms (Brickley and James, 1987). If board ownership is high, then a high proportion of outsiders may not be needed to maintain control. There was also a significant relation between both BSTK and OUT with absolute levels of cash and cash + options. This may reflect size differences because the relationship disappeared when cash and cash + options was measured in terms of growth rate ($\Delta\ln$).

Neither cash bonus as a proportion of cash compensation nor options as a proportion of cash compensation were statistically related to OUT or BSTK. This evidence is not consistent with the premise that board characteristics affect the degree that CEO compensation is tied to results. Consistent with the arguments noted above, it was expected that high outsider boards would rely on, and high ownership boards would insist on, a tight compensation-results link, implying greater use of stock options (which are inherently a function of market results) and cash bonus (which are often,

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[5] The regression analyses reported later were also replicated with market value of equity included to control for size differences, with no substantive change in the results.

Table 2
Frequency distribution of board stock ownership for the sample firms*

% of board stock ownership	*Number of firms*	*% of sample*
Board stock ownership ≤ 1%	88	32.8
1% < board ownership ≤ 2%	50	18.7
2% < board ownership ≤ 3%	25	9.3
3% < board ownership ≤ 4%	17	6.3
4% < board ownership ≤ 5%	9	3.4
5% < board ownership ≤ 6%	11	4.1
6% < board ownership ≤ 7%	5	1.9
7% < board ownership ≤ 8%	5	1.9
8% < board ownership ≤ 9%	6	2.2
9% < board ownership ≤ 10%	26	9.7
10% < board ownership ≤ 20%	2	0.7
20% < board ownership ≤ 50%	20	7.5
Board ownership > 50%	4	1.5
Total	268	100.0

*Board stock ownership is measured as the number of shares owned by board members, not including the CEO, multiplied by the year-end closing stock price and divided by market value of common equity

although not always, based on results). These results, however, suggest that boards with these characteristics may utilise subjective performance evaluation, thereby weakening the statistical link between firm performance (results) and compensation.

4.2. *Regression Analysis*

Regression analysis was used to examine the implicit relationship between CEO compensation and performance across OUT and BSTK. The following multiplicative-interaction regression model was employed:

$$\Delta \ln(\text{compensation}_t = \beta_0+\beta_1(\text{RET}_t)+\beta_2(\text{ROA}_t)+\beta_3(\text{OUT}_t) +\beta_4(\text{BSTK}_t)+\beta_5(\text{RET}_t \times \text{OUT}_t) +\beta_6(\text{ROA}_t \times \text{OUT}_t)+\beta_7(\text{RET}_t \times \text{BSTK}_t) +\beta_8(\text{ROA}_t \times \text{BSTK}_t)$$

We expected positive coefficient estimates for β_1 and β_2 to reflect rewards provided to the CEO for current performance and increases in stock price. No predictions were made about main effects for OUT and BSTK (β_3 and β_4). Significant interaction coefficient estimates for β_5, β_6, β_7 and β_8 would indicate a difference in slope coefficients across board characteristics.[6]

The regression estimates are shown in Table 4. Separate analyses are provided for CEO compensation defined as cash, as cash plus stock options, and as the value of equity owned by the CEO. Asymptotic standard errors under the hypothesis of heteroscedasticity are shown and significance tests are based on the corrected covariance matrix of the estimates (White, 1980).[7]

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[6] As a general check on our sample and measures, we compared our data to previous research. Gibbons and Murphy (1990) examined the relation between compensation and firm and industry return on common stock for a large sample of CEOs using the following regression model: $\Delta\ln(\text{compensation}_t) = \beta_1+\beta_2(\text{industry return})+\beta_3(\text{company return})$. We replicated Gibbons and Murphy's analysis, using our data, and found comparable results. Our coefficient estimate for company return (β_3) was 0.226 ($p<0.01$), corresponding to Gibbons and Murphy's estimate of 0.178 (p. 38). Our estimate for industry return (β_2) was −0.246 ($p<0.01$) using a 2-digit SIC definition for industry. This estimate was slightly larger but of the same sign as Gibbons and Murphy's estimate for 2-digit SIC industry return of -0.075.

[7] In addition to using White's heteroscedasticity correction as reported in the paper, the regressions were reanalysed using weighted least squares (WLS) with weights equal to the standard deviation of the error terms for proportion of board outsiders, and stock ownership calculated by splitting the sample into above and below the median subgroups (Neter and Wasserman, 1974). There was no appreciable change in the conclusions. We also tested for non-linearities by sorting the residuals

Table 3
Distribution statistics and correlations for measured variables

	Mean (S.D.)	Median	N	*Correlation (decimals omitted)*											
				2	3	4	5	6	7	8	9	10	11	12	13
1. Return on common stock (RET)[1]	−0.040 (0.33)	−0.040	268	334**	082	097	−061	152*	256**	094	097	−014	075	194	053
2. Return on assets (ROA)[2]	0.003 (0.05)	−0.001	268	—	026	−070	039	140*	150*	059	−029	088	030	401**	002
3. Market value of equity ($B)	3.22 (7.1)	1.35	268		—	070	−113	372**	063	398**	155*	−033	−013	110	233**
4. Proportion of outsiders (OUT)[3]	0.604 (0.13)	0.615	268			—	−225**	187**	082	194**	075	−106	065	102	013
5. Board stock ownership (BSTK)[4]	0.061 (0.11)	0.019	268				—	189**	−008	−185**	−026	006	−007	−116	−096
6. Cash compensation Amount (000s)[5]	942.4 (525.8)	829.6	268					—	−014	763**	119	−045	038	480**	045
7. Cash compensation Growth rate ($\Delta\ln$)[6]	0.016 (0.29)	0.036	268						—	−007	663**	−034	058	081	037
8. Cash+options Amount (000s)[7]	1,237.2 (795.7)	1,026.3	215							—	−037	−126	028	495**	626**
9. Cash+options Growth rate $\Delta\ln$)[8]	0.030 (0.45)	0.014	183								–	−043	042	−002	−261**
10. CEO equity value Amount (000s)[9]	2,140.6 (6,110.3)	4,491.9	251									–	063	−181	−117
11. CEO equity value Growth rate ($\Delta\ln$)[10]	0.764 (1.70)	0.066	238										—	123	039
12. Cash bonus/cash compensation	0.378 (0.23)	0.379	101											—	118
13. Options/cash compensation	0.365 (0.51)	0.193	215												—

[1] The sum of closing stock price plus dividends divided by opening stock price less mean common stock return for all other firms listed on Compustat in the same 2-digit SIC code as the sample firm.

[2] Income before tax, extraordinary items and discontinued operations divided by average total assets less mean ROA for all other firms listed on Compustat in the same 2-digit SIC code as the sample firm.

[3] Outsiders are defined as board members who are not current or former managers of the firm and have no family or significant financial relations with management.

[4] The number of shares owned by board members, not including the CEO, multiplied by the year-end closing stock price and divided by market value of common equity.

[5] Including cash bonus.

[6] $\Delta\ln$ (cash compensation).

[7] Stock options are valued using the Black and Scholes (1973) valuation model.

[8] $\Delta\ln$ (cash+stock options).

[9] Equity holdings valued using year-end closing stock price. Includes unexercised stock options.

[10] $\Delta\ln$ (value of equity).

Note: All compensation amounts are adjusted to 1990 dollars using the year-end CPI.

*$p < 0.05$; **$p < 0.01$

Table 4
Regression analysis of CEO compensation on return on common stock across board stock ownership and proportion of outsiders on the board of directors (asymptomatic standard errors in parentheses)[1]

	Δln(cash compensation) Model 1	Δln(cash+options) Model 2	Δln(value of equity) Model 3
Intercept	−0.039	−0.151	0.824
	(0.103)	(0.206)	(0.789)
Return on assets (ROA)[2]	−1.198	0.888	−14.33
	(1.199)	(2.725)	(12.40)
Return on common stock (RET)[3]	0.809**	−0.867	5.06
	(0.262)	(0.852)	(2.637)
Proportion of outsiders (OUT)[4]	0.099	0.293	0.0462
	(1.999)	(0.306)	(1.185)
Board stock ownership (BSTK)[5]	0.140	−0.107	−0.568
	(0.155)	(0.350)	(1.064)
OUT × RET	−1.123**	1.460	−7.173
	(0.389)	(1.282)	(4.010)
OUT × ROA	2.059	−4.047	22.74
	(3.289)	(4.475)	(21.207)
BSTK × RET	1.036**	1.673*	−6.182
	(0.366)	(0.829)	(3.207)
BSTK × ROA	7.682**	20.769**	15.01
	(2.842)	(6.614)	(13.595)
F-statistic	4.996**	2.087*	1.216
Adj. R-square	0.11	0.05	0.01
Observations	268	183	238

[1] Asymptotic standard errors under the hypothesis of heteroscedasticity are shown, and significance tests are based on the corrected covariance matrix of the estimates (White, 1980).
[2] Income before tax, extraordinary items and discontinued operations divided by average total assets less mean ROA for all other firms listed on Compustat in the same 2-digit SIC code as the sample firm.
[3] The sum of closing stock price plus dividends divided by opening stock price less mean common stock return for all other firms listed on Compustat (excluding the sample firm) in the same 2-digit SIC code as the sample firm.
[4] Outsiders are defined as board members who are not current or former managers of the firm and have no family or significant financial relations with management.
[5] Board stock ownership is measured as the number of shares owned by board members, not including the CEO, multiplied by the year-end closing stock price and divided by market value of common equity.
Note: All compensation amounts are adjusted to 1990 dollars using the year-end CPI.
*$p < 0.05$; **$p < 0.01$

For model 1, cash compensation, the significant ($p < 0.01$) coefficient estimate for (BSTK × RET) indicates that the relation between cash compensation and RET was significantly stronger for high board ownership firms than for low board ownership firms. Similarly, the significant ($p < 0.01$) coefficient estimate for (BSTK × ROA) indicates that the relation between cash compensation and ROA was significantly stronger for high board ownership firms than for low board ownership firms. This evidence suggests that high ownership boards tied CEO cash compensation more strongly to firm results than low ownership boards.

The results for OUT in model 1 were more ambiguous. The coefficient estimate for (OUT × ROA) was not statistically significant, and the coefficient estimate for (OUT × RET) was significant but negative. Thus, the proportion of outsiders on the board appeared to have no effect on the link between CEO cash compensation and ROA, and had a negative effect on the link between CEO cash compensation and RET. These results indicate that the proportion of outsiders did not alter the relation between CEO compensation and RET or ROA. As discussed further below, one explanation for this finding may be re-

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by each of the board characteristics and calculating a Durbin-Watson statistic. Non-linearities for each board characteristic would be evident as correlated errors. None of the Durbin-Watson statistics were significant, and all of the first-order autocorrelation statistics were less than 0.1.

lated to cross-sectional changes in board composition over the past few years. Given recent mandated changes in board composition, the proportion of outsiders on the board may no longer be an indication of board monitoring.

The results for model 2 for cash + options were similar to the results for model 1. The significant positive coefficient estimate for (BSTK × RET) and (BSTK × ROA) indicates that high ownership boards tied cash + option compensation more strongly to firm results (both ROA and RET) than low ownership boards. The proportion of outsiders on the board, however, had no effect on the relation between CEO compensation and ROA or RET.

Model 3, for $\Delta \ln$(value of equity) as the compensation measure, was not statistically significant at conventional levels ($F = 1.22$). None of the coefficient estimates approached significance. Very little theoretical support is available for predictions about the empirical relationship between firm performance, board of director characteristics, and CEO shareholdings. Moreover, attempts to study the motivational effects of CEO shareholdings are likely to be confounded by the inability to estimate a CEO's total wealth. The motivational effects of shareholdings may be dependent on the executive's ability to diversify his or her total portfolio to offset firm-specific risk. Compensation system designers may anticipate the CEO's actions and alter contract terms.

4.3. Controlling for Shareholdings by Outsiders and the CEO

Large shareholders are likely to engage in more monitoring since they bear a relatively greater cost from management's non-value-maximising behaviour. Thus, rational managers are less likely to engage in such behaviour (Morck, et al. 1990). Agrawal and Mandelker (1990) for example, find a lower incidence of value-decreasing anti-take over amendments in firms with large outside shareholders. In addition, since CEOs with relatively large shareholdings bear a greater cost of their own non-value-maximising behaviour, CEO ownership of shares may provide an effective deterrent to behaviour that reduces firm value. Lewellyn et al. (1985), for example, reported higher returns to firms making acquisitions when top management had a larger equity share.

Overall, since large shareholdings by the CEO or by outsiders may mitigate agency problems, these factors rather than board monitoring could account for the previous results. To test this hypothesis, the analysis was extended to include shareholdings by the CEO and by outsiders. The data about shareholdings were gathered from proxy statements. Shareholders with a greater than 5% ownership interest were separately identified in proxy statements, and the CEO's shareholdings were explicitly disclosed. Outsider ownership was measured as a dichotomous variable set to 1 if an individual or institution held a 5% or larger block of common stock. CEO shareholdings were measured as a percentage of market value.

Mean values and correlations of outsider and CEO shareholdings with OUT and BSTK are shown in Table 5. OUT was negatively correlated with BSTK, as noted above. OUT was also negatively related to CEO shareholdings. Weisbach (1988) also reported an inverse relation between CEO shareholdings and the proportion of outsiders on the board. Weisbach proposed that as a CEO's shareholdings increase, his or her interests become more aligned with the shareholders', and the need for monitoring by outside directors is reduced. Alternatively, as shareholdings increase, the CEO may be more effective at keeping outsiders off the board.

Table 6 shows regression results after inclusion of CEO and outsider ownership. As in Table 4, coefficient estimates in model 1 (cash compensation) for both (BSTK × RET) and (BSTK × ROA) were significantly positive, indicating that the relation between cash compensation and RET and ROA was significantly stronger for high board ownership firms than for low board ownership firms. This evidence again suggests that high ownership boards tied CEO cash compensation more strongly to firm results than low ownership boards. The results for OUT in model 1 were again ambiguous. The coefficient estimate for (OUT × ROA) was not statistically significant, and the coefficient estimate for (OUT × RET) was significant but negative. This again suggests that the proportion of outsiders on the board had no effect on the link between cash compensation and ROA, and had a negative effect on the link between cash compensation and RET.

The results for model 2, for cash + options, in Table 6 were also similar to the results in Table 4. High ownership boards tied compensation more strongly to ROA than low ownership boards. High ownership boards also tied cash + option compensation more strongly to RET, but the coefficient estimate was only marginally significant ($p < 0.1$). Overall, the results, after including outsider and CEO shareholdings in the regression model, remain consistent with the earlier results in Table 4.

It is interesting to note the significant interaction effects of CEO ownership (CSTK) with RET on CEO compensation shown in Table 6. For model 2, cash + options, the interactions coefficient for (CSTK × RET) was statistically significant, and for cash compensation, the interaction coefficient for (CSTK × RET) was marginally significant ($p, < 0.1$). This suggests that CEO ownership had important effects on the compensation-performance relation, but that the effect was apparently

Table 5
Distribution statistics and correlations for board characteristics, outsider and CEO shareholdings

	Mean (S.D.)	*Median*	*Correlations (decimals omitted)* 2	3	4
1. Proportion of outsiders (OUT)[1]	0.604 (0.13)	0.615	−225**	037	−197**
2. Board stock ownership (BSTK)[2]	0.061 (0.11)	0.019	—	−091	012
3. Outside ownership (OSTK)[3]	0.616 (0.49)	1.00	—	058	
4. CEO stockownership/firm market value (CSTK)[4]	0.030 (0.07)	(0.004)			

[1] Outsiders are defined as board members who are not current or former managers of the firm and have no family or significant financial relations with management.

[2] Board stock ownership is measured as the number of shares owned by board members, not including the CEO, multiplied by the year-end closing stock price and divided by market value of common equity.

[3] Indicator variable set to 1 if a blockholder is present with greater than 5% of stock ownership, and 0 otherwise.

[4] Number of shares owned by the CEO multiplied by the year-end closing stock price and divided by firm market value.

*$p<0.05$; **$p<0.01$

independent of, or in addition to, the effects of board characteristics. Theory to identify how CEO shareholdings should affect the performance-compensation relation is not well developed. CEOs with large shareholdings may be able to dominate the board and receive large rises regardless of firm performance. Alternatively, subjective performance evaluation may be used more often for these CEOs, which would weaken the link between firm performance and compensation. Our preliminary results seem to support the latter interpretation.

5. Discussion

This study examined empirically the proposition that chief executive compensation is more closely linked to corporate performance in firms with high outsider boards and boards with significant shareholdings, than in firms with other board characteristics. Despite the absence of a body of supporting empirical evidence, critics of corporate governance have called for regulation of these two variables as important factors in the board's ability to represent shareholder interests. These arguments appear to be based on the assumptions that outsiders are more likely to maintain objectivity in compensation decisions and that share ownership provides boards with an incentive to rigorously monitor executive performance.

Our results, however, were mixed. First, the proposition that board ownership would be associated with a closer performance-compensation link was supported by the data. For high board ownership firms, CEO compensation was more positively related to both measures of corporate performance than for low board ownership firms. These results are consistent with arguments by Morck et al. (1988) that directors' response to incentives corresponds to that of corporate officers. In keeping with the convergence-of-interests hypothesis, directors' contribution to corporate wealth is greater at higher levels of ownership. These data also support governance critics calling for increased levels of board ownership (Herman, 1981; Roe, 1992). While directors may have an incentive to protect their reputations as 'decision control experts', as argued by Fama and Jensen (1983:315), stock ownership may provide them with an additional incentive to insure that compensation is based on changes in shareholder wealth.

This finding of a positive relationship between board ownership and outcome-based compensation is inconsistent with Weisbach's (1988) report that monitoring, as he measured it, was unaffected by board ownership. Weisbach, however, defined monitoring in terms of CEO terminations, a far more extreme event than compensation decisions. It might be argued that termination represents a more conservative test of the performance-reward relationship (i.e. if a board dismisses an inadequate CEO, we can be sure it is relating rewards to performance). It is possible, however, that termination is too conservative a test. That is, while ownership may provide the board with sufficient

Table 6
Regression analysis of CEO compensation on return on common stock across board stock ownership and proportion of outsiders on the board of directors, controlling for stock ownership by outsiders and the CEO (asymptomatic standard errors in parentheses)[1]

	Δln(cash compensation Model 1	Δln(cash+options) Model 2	Δln(value of equity) Model 3
Intercept	−0.005	−0.184	0.932
	(0102)	(0.175)	(0.862)
Return on assets (ROA)[2]	−1.764	0.569	−14.260
	(1.853)	(2.669)	(12.375)
Return on common stock (RET)[3]	1.212**	−0.075	6.590*
	(0.315)	(0.634)	(3.187)
Proportion of outsiders (OUT)[4]	0.074	0.339	0.163
	(0.153)	(0.261)	(1.187)
Board stock ownership (BSTK)[5]	0.130	−0.126	−0.783
	(0.174)	(0.361)	(1.060)
Outsider stock ownership (OSTK)[6]	−0.016	0.024	−0.304
	(0.032)	(0.061)	(0.249)
CEO stock ownership/firm market value (CSTK)[7]	−0.325	−0.277	0.827
	(0.402)	(0.645)	(1.794)
OUT × RET	−1.763**	0.337	−8.996*
	(0.461)	(1.008)	(4.267)
OUT × ROA	3.131	−5.247	20.001
	(3.022)	(5.031)	20.496
BSTK × RET	0.973*	1.293	−6.446
	(0.381)	(0.762)	(3.107)
BSTK × ROA	8.299**	21.352**	18.971
	(2.975)	(6.141)	(13.566)
OSTK × RET	0.135	0.226	−0.295
	(0.094)	(0.182)	(0.883)
OSTK × ROA	−0.443	0.790	2.759
	(0.759)	(1.580)	(4.800)
CSTK × RET	−2.4111	−4.374**	−4.061
	(1.335)	(1.549)	(5.391)
CSTK × ROA	2.948	5.474	−36.173
	(6.737)	(11.991)	(39.022)
F-statistic	4.075**	2.488**	0.97
Adj. R-square	0.14	0.10	−0.00
Observations	268	183	238

[1] Asymptotic standard errors under the hypothesis of heteroscedasticity are shown, and significance tests are based on the corrected covariance matrix of the estimates (White, 1980).
[2] Income before tax, extraordinary items and discontinued operations divided by average total assets less mean ROA for all other firms listed on Compustat in the same 2-digit SIC code as the sample firm.
[3] The sum of closing stock price plus dividends by divided opening stock price less mean common stock return for all other firms listed on Compustat (excluding the sample firm) in the same 2-digit SIC code as the sample firm
[4] Outsiders are defined as board members who are not current or former managers of the firm and have no family or significant financial relations with management.
[5] Board stock ownership is measured as the number of shares owned by board members, not including the CEO, multiplied by the year-end closing stock price and divided by market value of common equity.
[6] Indicator variable set to 1 if a blockholder is present with greater than 5% of stock ownership, and 0 otherwise.
[7] Number of shares owned by the CEO multiplied by the year-end closing stock price and divided by firm market value.
Note: All compensation amounts are adjusted to 1990 dollars using the year-end CPI.
*$p < 0.05$; **$p < 0.01$

power to influence an executive's compensation, it does not necessarily provide enough power to cause dismissal, an event that is politically and organisationally traumatic for most firms. As Morck et al. (1988) argue, managerial entrenchment is not simply a function of voting power. A top manager may become entrenched by virtue of organisational tenure, status as a founder, or personal charisma, despite a small equity position relative to the board's. Thus, it may not be unreasonable that we found board ownership to be associated with the setting of CEO compensation, a relatively routine event, while Weisbach (1988) found that board ownership was not associated with the extraordinary event of CEO dismissal.

While arguments regarding board ownership were supported, expectations of an outsider effect were not. Based on the popular logic that outside directors are better able to monitor and control management, we sought evidence that high outsider boards maintained a strong performance-compensation link. However, we did not find CEO compensation to be related more strongly to firm performance for high outsider boards than for low outsider boards. One explanation for this finding may have to do with cross-sectional changes in board composition over the past few years, specifically, increases in the proportion of outside directors. These increases may be occurring, at least partially, in response to recent criticisms of corporate governance, as cited above. Rosenstein and Wyatt (1990) also concluded that the proportion of outsiders on boards of directors has increased markedly in recent years. They cite recent New York Stock Exchange regulations requiring outsider representation on the board's audit committee as a contributing factor (Kesner, 1988). Consistent with these changes, the distribution of the proportion of outsiders appeared to be more limited in this sample than in Weisbach's (1988) sample taken from 1980. Over 80% of the firms in this sample had boards within the range of 60%–90% outsiders. Weisbach reported only 32% of the firms in his sample to be within this range. This suggests that the proportion of outsiders on the board may no longer provide a signal about outcome control; instead, board composition may now be a reflection of regulatory and political forces. A time-series examination of board composition may be required for additional insight into this issue.

Other possible explanations for the absence of an outsider association with outcome-based compensation, perhaps of greater theoretical interest, is that outsider directors either do not reply on outcomes as a basis for monitoring and controlling the CEO, or that outsiders are unable or unwilling to impose a strict outcome-based evaluation process on the CEO. The first explanation calls into question the assumption of an information deficit on the part of outsiders. It is possible that outsiders have both the access and the ability to incorporate subtle information into their evaluations of executive performance, thus mitigating the simple outcome-reward relationship. Evidence from prior research, in fact, suggests that relative performance information (i.e. performance relative to industry peers) acts as a moderator of the performance-compensation link (Antle and Smith, 1986; Gibbons and Murphy, 1990; Kerr and Kren, 1992).

The second explanation calls into question the assumption that outsiders are relatively independent of executive influence and thus better able to represent shareholder interests. In fact, a cost of the outside director's objectivity may be an information deficit (relative to insiders) regarding the CEO's true capability, effort and responsibility for performance outcomes. Insufficient information may leave the board's compensation committee, typically dominated by outsiders, dependent on compensation consultants or other advisers who can only provide reward guidelines based on comparisons with firms that are similar in size, product range, profitability or other broad characteristics. Thus, the benefits of the outside board's objectivity and disinterest may be obtained at the cost of arm's-length compensation decisions that are based more on a firm's general characteristics than on the specifics of its performance. To the extent that shareholders' interests benefit from a closer relationship between corporate performance and executive compensation, results from this study suggest that these interests may be better served by increases in board shareholdings than by regulation of board composition.

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UK Auditor Concentration: A Descriptive Note

Michael J. Peel*

Abstract—This note describes supplier concentration in the UK market for audit services. It extends previous research, which has focused on listed markets, by examining auditor concentration ratios across all corporate (quoted, unquoted plc and private) sub-markets. Individual and combined Big Six supplier concentration (CR6) ratios are calculated with reference to the number of clients audited, corporate size and disclosed audit fees. Compared with previous studies, the analysis is based on a larger number (171,799) of corporate audits, and indicates that, inter alia, corporate size (across different sub-markets) is a key determinant of supplier concentration. However, variations are reported in relation to individual auditors, auditee size and corporate sub-sectors. Other key findings are that the CR6 ratio in the quoted market has continued to rise in recent years, from 72.3% in 1991 (Beattie and Fearnley, 1994) to 78.4% in 1994/95, and that the Big Six currently audit a substantial proportion (58.2%) of companies in the UK middle market, which they appear to be targeting, as the large auditee sub-sector becomes saturated, to increase market share.

1. Introduction

Since the first US supplier concentration studies were published (Burton and Roberts, 1967; Zeff and Fossum, 1967) a perennial issue has been the extent to which the large (Big Six, Big Eight) auditors control or dominate the supply of audit services. This is perceived to be an important research issue (Moizer and Turley, 1989) because of its hypothesised impact on market competition and large audit firm market behaviour. The extant research on the large auditee market reveals that measures of large audit firm concentration have increased significantly through time. For example, comparable studies demonstrate that the proportion of the UK listed market audited by the six largest auditors rose from 20.7% in 1968 (Briston and Kedslie, 1985) to 72.3% in 1991 (Beattie and Fearnley, 1994). Although an increasing number of descriptive supplier concentration studies have appeared in recent years (see Yardley et al., 1992), the extant research focuses on listed/quoted firms, or the leading (largest) companies within particular listed markets, and has not examined how concentration ratios vary across different corporate sub-markets.[1]

The purpose of this note, therefore, is to fill this gap by providing some new descriptive evidence on supplier concentration in all corporate sectors of the UK market for audit services in 1994/95. Besides examining Big Six audit concentration ratios of quoted[2] UK firms (first market, Unlisted Securities Market (USM) and Alternative Investment Market (AIM)), the paper provides similar evidence for unquoted public limited companies (plcs) and private (closely-held) firms. Individual and combined Big Six supplier concentration ratios are broken down by corporate size (sales) and auditor revenue (disclosed statutory audit fee).

Based on the auditor choice and agency literature (e.g. Thornton and Moore, 1993) there is an expectation that, cet. par., quoted firms will be characterised by higher supplier ratios than unquoted plcs, which in turn should exhibit higher ratios than private (closely-held) firms. This expectation is based on the premise that large audit (Big Six) firms are associated with a 'higher quality' differentiated audit product—in that the extant literature indicates that large audit firms are more independent (DeAngelo, 1981), possess more in-

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*The author is a senior research fellow at the Cardiff Business School, University of Wales. The detailed comments and suggestions made by two anonymous referees are gratefully acknowledged. Correspondence should be addressed to the author at the Cardiff Business School, Colum Drive, Cardiff CF1 3EU. This paper was submitted in August 1996 and accepted in May 1997.

[1] However, an examination of the audits of 4,000 UK private companies by JDH consultants in 1992 discovered that the largest 12 audit firms had a combined market share (in terms of clients audited) of 28.7% (Thompson, 1992). In addition, a survey of 12,000 companies based in eastern England in 1990 by *Accountancy Age* reported that the largest three audit firms accounted for 40% of the total audit fees of the 8,680 firms that disclosed audit fees in their annual report and accounts (Lea, 1990).

[2] In this study 'quoted' refers jointly to those (first market) firms quoted on the Stock Exchange *Official List*, companies quoted on the USM and those quoted on the new Alternative Investment Market (AIM). Following an EU directive the USM began to close in 1994, with firms being able to transfer to the listed market or the new AIM before final closure in December 1996. Launched in June 1995, the AIM is designed for smaller, more risky, firms that wish to raise equity finance. By the end of May 1996, no companies had transferred from the USM to the AIM (KPMG, 1996).

dustry expertise and employ superior audit tests (DeFond, 1992). A further expectation is that larger companies (in all corporate sectors) are more likely to be audited by larger (Big Six) auditors; in that larger, more complex, organisations are more likely to require the technical expertise and resources of larger audit firms (Moizer and Turley, 1987; Keasey and Watson, 1991).

2. Data and method

The FAME (Financial Analysis Made Easy) CD-Rom corporate database (produced by Jordans UK) is used to examine supplier concentration. FAME, which is updated on a monthly basis, includes financial and non-financial information (extracted from annual reports and other information filed at Companies House) on nearly 190,000 UK companies. It contains information on all major UK companies—that is quoted and unquoted plcs—together with a large number (181,755) of private firms. Companies are included in the database if they meet at least one of the following criteria: (i) a turnover of £500,000 or more; (ii) pre-tax profits of £50,000 or more; and (iii) shareholders' funds of £250,000 or more. The database is therefore biased against the smallest UK firms. However, it does include a substantial number of smaller firms which, although not currently meeting the above criteria, have appeared in previous surveys published by Jordans and are retained in the database. At the time of this study (1996), for example, excluding failed firms, the database contained the following number[3] of smaller companies: (i) 25,061 with turnover below £500,000; (ii) 61,137 with pre-tax profits below £50,000, of which 31,183 (51%) were loss-making; and (iii) 59,002 with shareholders' funds below £250,000.

On the basis of Department of Trade and Industry data, Jarvis (1996:8) estimated that there were 663,811 live unlisted (not quoted on the Stock Exchange) companies that filed annual accounts in 1994/95 at Companies House in compliance with the statutory requirements in the Companies Acts. Excluding the 5,208 live unquoted plcs on the FAME database with account year ends (1994/95) falling in this period, this would suggest that there were 658,603 live private firms which filed accounts in 1994/95. Therefore, as Table 1 reveals, the sample of 164,726 live private firms examined in this study comprises about 25% of the population of UK live private firms. As noted above, although this is a very large sample, it is probably biased towards larger private firms. In addition, FAME's proprietors do not indicate how smaller private firms are selected for inclusion in the database, which may also lead to self-selection bias if such companies can influence their selection.

At the time of this study, (1996), the database contained information for companies with account year ends falling in 1994/95. However, in common with other corporate financial databases, FAME contains a separate search procedure to identify 'dead' firms—that is, companies originally included on the database (which originated in 1988), but which have since failed/ceased trading. These firms were excluded to ensure that the reported supplier concentration ratios fell in a common time period. As Table 1 shows, the audits[4] of 171,799 companies with financial year ends falling in 1994/95 were examined, of which 1,865 (1.1%) are quoted on the Stock Exchange, 5,208 (3%) are unquoted plcs and 164,726 (95.9%) are private firms.

3. Results

3.1. Market Concentration by Number of Audits

Table 2 presents descriptive information on Big Six supplier[5] concentration ratios based on the proportion (%) of each market audited (that is the number[6] of Big Six company audits relative to all company audits); Table 3 provides the relative rankings of individual auditors derived from the market share information presented in Table 2. By reference to the combined Big Six market share concentration (CR6) ratios, Table 2 reveals that, for the quoted market sector (and consistent with prior expectations), the CR6 ratio declines from 81.1% in the first market, to 57.7% in the USM, to 48.1% in the new AIM. In total, therefore, the Big Six undertake a very high proportion (78.4%) of all audits in the quoted corporate sector.

Table 2 also shows that the Big Six audited 47.9% of all audits (5,208) in the unquoted plc market (giving a CR6 ratio of 55.9% for all plcs); but the CR6 ratio for unquoted plcs (47.9%) is only marginally lower than for those plcs quoted

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[3] The sum of smaller companies (145,200) includes firms falling in more than one category—that is, turnover, pre-tax profits and shareholder funds.

[4] All the companies (171,799) examined in this study had undergone a statutory audit. However, since 11 August 1994, UK smaller companies (with annual turnover below £350,000 and gross assets less than 1.4m) are not required (under the Companies Acts) to have a statutory audit. Companies with an annual turnover between £90,000 and £350,000 were given the option of filing a simpler reporting accountant's 'exemption report', whereas those with an annual turnover below £90,000 per annum are entirely exempt from the audit requirement.

[5] In common with the ICAEW survey of auditors' income (see *Accountancy*, 1995) the audits of Binder Hamlyn and Arthur Andersen were pooled following their merger on 1 October 1994. Following the merger of Deloitte and Touche in the US (but not the UK) in 1992, Touche Ross changed its name to Deloitte and Touche in February 1996 as part of its campaign to provide a single global identity (*The Times*, 1996).

[6] Following previous studies (Beattie and Fearnley, 1994; Moizer and Turley, 1989) joint audits were allocated on a 0.5 basis between the auditors (Big Six) concerned.

Table 1
Companies analysed

	Public quoted	*public unquoted*	*Private*	*All firms*
Number with auditor specified	1,875	5,853	181,755	189,483
Ceased trading/disssolved/failed*	(10)	(645)	(17,029)	(17,684)
Number of companies analysed	1,865	5,208	164,726	171,799

*Failed = liquidation/receivership/administration

on the new AIM (48.1%). This suggests relatively low audit switching to Big Six firms for established plcs (or the initial choice of Big Six firms for newly-incorporated firms) seeking a quotation on the AIM.[7]

Consistent with prior expectations, of the 164,726 private (close) companies analysed in Table 2, 28.6% were audited by the Big Six—just over half of the CR6 ratio (55.9%) for all plcs—demonstrating the significantly different characteristics of the plc and private sector sub-markets. Previous studies (Yardley et al., 1992) have also reported concentration ratios based on the combined market shares of the four largest (CR4) auditors. In this context, the CR4 ratio for the combined first market and USM in 1994/95 (61.7%) has increased (by 2.8 percentage points) relative to the comparable 1991 ratio (58.9%) reported by Beattie and Fearnley (1994).

Table 2 reveals that KPMG has the largest market share across all corporate sub-sectors (although tied for first on the new AIM with Arthur Andersen), conducting a fifth (20.2%) of all quoted audits, 14% of all plc audits and 7.4% of private company audits—amounting to 7.6% of all the corporate audits (171,799) analysed. Table 3 also shows that, although some of the auditor rankings vary across the different plc sub-markets, the relative rankings in relation to the whole plc (quoted and unquoted) and private company sub-sectors is identical—that is KPMG, followed by Coopers & Lybrand, Ernst & Young, Price Waterhouse, Touche Ross and Arthur Andersen. Furthermore, Table 3 shows that Price Waterhouse and Touche Ross are ranked fourth and sixth respectively for all quoted firms; but that the rankings shift significantly in the unquoted plc sub-market, with the former ranked sixth, and the latter third. These variations suggest that audit specialisation is occurring in these sub-markets (see, for example, Yardley et al., 1992).

3.2. *Market Concentration by Firm Size*

Tables 4-6 report supplier concentration ratios across six identical sales bands in the private (Table 4), the unquoted plc (Table 5) and quoted corporate sectors (Table 6). The six sales categories were selected to enable variations in the sub-markets to be identified, across a range of very small (less than £100k) firms to very large ones (£500m+). A middle market size category (£5m to £200m) was selected by reference to the definition (sales range) of the UK middle market used in the *Middle Market Barometer* surveys[8] (see Coopers & Lybrand, 1996a). Although it is a relatively large sales band, the middle market category is of particular interest in that one professional commentator (Bruce, 1996) has speculated that the saturation of the large company audit market by the Big Six has resulted in them competing more aggressively for market share in the middle market.

Tables 4-6 show that there are significant differences across sub-markets in respect of the smallest firms analysed (less than £100k)—with the CR6 ratio being only 15.9% in the private company sector (Table 4), rising to more than double this (33.8%) for unquoted plcs (Table 5), and to 53.8% in the quoted market (Table 6). However, although a relatively small proportion of 'very small' private sector firms are audited by the Big Six, a

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[7] This could be investigated in more detail by examining whether established plcs seeking a quotation on the AIM switch auditors. For example, the choice of Big Six auditor is associated with increased share prices (a premium) on securities initially floated (new issues) on equity markets (Yardley et al., 1992).

[8] In interpreting the results in Tables 4-6, it should be noted that the analysis is based on a smaller number of audit observations than those reported in Table 2 because: (i) investment trusts, and other financial firms, do not report sales figures; and (ii) under the Companies Acts, small and medium-sized firms may choose not to disclose sales figures in annual accounts, although they may voluntarily do so. However, for companies with turnover exceeding £5m, Coopers & Lybrand (1996b) have estimated that there are approximately 28,500 companies in the UK with a turnover of over £5m, which is very similar to the number (28,457) contained in the FAME database with sales of £5m+ used in this study (see Tables 4-6).

Table 2
Audit concentration by corporate markets (No. of audits*)

Auditors†	*Listed on 1st market (n=1,680)*	*USM[1] (n=104)*	*AIM[2] (n=81)*	*All quoted (n=1,865)*	*Public unquoted (n=5,208)*	*All public (n=7,073)*	*Private firms (n=164,726)*	*All firms (n=171,799)*
KPMG	21.0% (n=353)	14.4% (n=15)	11.1% (n=9)	20.2% (n=377)	11.8% (n=616.5)	14.0% (n=993.5)	7.4% (n=12,129.5)	7.6% (n=13,123)
Coopers & Lybrand	16.7% (n=280)	10.6% (n=11)	6.2% (n=5)	15.9% (n=296)	9.7% (n=502.5)	11.3% (n=798.5)	5.4% (n=8,818)	5.6% (n=9,616.5)
Ernst & Young	13.7% (n=230)	6.7% (n=7)	8.6% (n=7)	13.1% (n=244)	7.0% (n=367)	8.6% (n=611)	5.1% (n=8,328.5)	5.2% (n=8,939.5)
Price Waterhouse	11.8% (n=199)	5.8% (n=6)	4.9% (n=4)	11.2% (n=209)	5.9% (n=306)	7.3% (n=515)	3.7% (n=6,149.5)	3.9% (n=6,664.5)
Touche Ross	9.1% (n=153)	7.7% (n=8)	6.2% (n=5)	8.9% (n=166)	7.2% (n=377)	7.7% (n=543)	4.0% (n=6,630)	4.2% (n=7,173)
Arthur Andersen	8.8% (n=148)	12.5% (n=13)	11.1% (n=9)	9.1% (n=170)	6.2% (n=324)	7.0% (n=494)	3.0% (n=4,979.5)	3.2% (n=5,473.5)
BIG Six	81.1% (n=1,363)	57.7% (n=60)	48.1% (n=39)	78.4% (n=1,462)	47.9% (n=2,493)	55.9% (n=3,955)	28.6% (n=47,035)	29.7% (n=50,990)

[1] USM = Unlisted Securities Market
[2] AIM = Alternative Investment Market
*n indicates the number of audits in each sector and the number of audits conducted by the specified auditors in each sector
†percentages refer to the proportion of each sector audited

Table 3
Ranking by number of clients audited*

Auditors	*Listed on 1st market*	*USM*	*AIM*	*All quoted*	*Public unquoted*	*All public*	*Private firms*	*All firms*
KPMG	1	1	1=	1	1	1	1	1
Coopers & Lybrand	2	3	4=	2	2	2	2	2
Ernst & Young	3	5	3	3	4	3	3	3
Price Waterhouse	4	6	6	4	6	5	5	5
Touche Ross	5	4	4=	6	3	4	4	4
Arthur Andersen	6	2	1=	5	5	6	6	6

*Rankings are based on the proportion (%) of audits conducted (Table 2)

CR6 ratio approaching 16% is substantial.[9] Other than in respect of the unquoted plc market (where there is a decline in the CR6 ratio in the £100k to £5m sales ranges), Tables 4-6 reveal a (generally) positive association between corporate size (ranges) and CR6 ratios in the three sub-markets.

With saturation of the large firm audit market, Big Six auditors have been competing more aggressively for market share in the middle market (Bruce, 1996). Tables 4-6 reveal that 58.2% of all sample firms (27,094) in the middle market were audited by the Big Six—with the CR6 ratio being highest (76.7%) in the quoted sector, followed by the private sector (57.7%) and unquoted plc sector (54.2%). Hence the Big Six currently audit more than half of all firms in the middle market. Although the CR6 ratio for middle market firms is highest in the quoted sector (76.7%), the middle market CR6 ratio is (perhaps surprisingly) higher in the private sector (57.7%) than in the unquoted plc market (54.2%).

Tables 4-6 reveal that 91.1% of the 1,215 largest auditees (sales of £200m+) are audited by the Big Six—with CR6 ratios of 93.1% in the quoted sector, 90.9% in the unquoted plc market and 90.3% in the private sector. The similarity of these CR6 ratios support the hypothesis that corporate size is likely to be the key characteristic determining the likelihood of a company being audited by a Big Six auditor, with ownership status (quoted, unquoted plc, private), appearing to be a more influential determinant in the smaller-firm sector. These observations tend to be reinforced by reference to the analysis in Tables 4-6, where the large firm corporate sector is sub-divided into those with sales between £200m and £500m, and those with sales of 500m+. The CR6 ratio increases in line with the general positive trend noted above, with the Big Six auditing a very stable proportion of companies in the largest size segment (£500m+) across the private (CR6 = 94.1%), the unquoted plc (95.2%) and the quoted (96.7%) sub-markets (a range of only 2.6%).

Tables 4-6 also reveal variations in individual auditor concentration ratios and relative rankings. For example, although Arthur Andersen ranks only sixth (with a 1.4% market share) and fourth (3.6%) in the smallest firm (sales less than £100K) segments of the private and unquoted plc sub-markets, it ranks first in the quoted sector, with a market share (30.7%) almost double that (15.4%) of its nearest rival (Ernst & Young). In the private corporate sector, although KPMG, Coopers & Lybrand and Ernst & Young maintain their relative rankings (first to third respectively) for all size segments in the small and middle-tier audit sectors, some variations are apparent in respect of larger firms: Coopers & Lybrand had the highest share (25.9%) of the audits of the largest private firms (£500m+), followed by Price Waterhouse (22.6%) and KPMG (18.9%).

In the middle market (£5m to £200m), Arthur Andersen has a relatively high ranking (third) in the unquoted plc sector (with a 9.5% market share), and is sixth in the private sector and fifth in the quoted sector in this size band. Furthermore, Table 5 shows that Price Waterhouse appears to have targeted the audits of the largest firms in the unquoted plc sub-sector, ranking sixth by reference to all the audits (with a market share of 4.9%), but first in both large firm categories, with market shares of 20.9% (£200m to £500m) and 22% (£500m+) respectively. Overall, these variations in Big Six market shares across different

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[9] As noted in the paper, although attempting to control broadly for firm size in Tables 4-6, there may be an upward size bias, since smaller firms (not voluntarily disclosing sales figures) are excluded from Table 4. However, the CR6 ratio (28.6%) based on the number of audits in the private sector (Table 2, n = 164,726)—and the CR6 ratio (33.9%) for those private firms disclosing sales revenue (Table 4, n = 96,014)—would suggest that any bias does not impact substantially on the reported summary statistics.

Table 4
Private company audits by size (sales bands)

	Proportion (%) of firms audited and rankings†							
Sales (£)	*KPMG*	*Coopers & Lybrand*	*Ernst & Young*	*Price Waterhouse*	*Touche Ross*	*Arthur Andersen*	*Big Six*	*N=**
∠100k	4.2%	3.1%	2.9%	1.7%	2.6%	1.4%	15.9%	10,222
Rank	1	2	3	5	4	6		
100k to ∠2m	5.9%	4.1%	4.0%	2.6%	3.8%	2.3%	22.6%	43,406
Rank	1	2	3	5	4	6		
2m to ∠5m	9.7%	7.0%	6.6%	4.1%	5.7%	4.0%	37.1%	17,305
Rank	1	2	3	5	4	6		
5m to ∠200m	14.5%	11.1%	9.7%	8.0%	7.5%	6.9%	57.7%	24,273
Rank	1	2	3	4	5	6		
200m to ∠500m	21.7%	16.0%	16.4%	15.4%	9.3%	9.7%	88.5%	538
Rank	1	3	2	4	6	5		
500m+	18.9%	25.9%	14.4%	22.6%	5.6%	6.7%	94.1%	270
Rank	3	1	4	2	6	5		
All firms	8.7%	6.4%	5.9%	4.2%	5.0%	3.7%	33.9%	96,014
Rank	1	2	3	5	4	6		

†Percentages refer to the proprotion of companies audited in each sales band
*N = the number of companies in each sales band

Table 5
Public (unquoted) company audits by size (sales bands)

	Proportion (%) of firms audited and rankings†							
Sales (£)	*KPMG*	*Coopers & Lybrand*	*Ernst & Young*	*Price Waterhouse*	*Touche Ross*	*Arthur Andersen*	*Big Six*	*N=**
∠100k	12.0%	3.1%	8.0%	1.3%	5.8%	3.6%	33.8%	225
Rank	1	5	2	6	3	4		
100k to ∠2m	8.9%	4.8%	3.1%	2.1%	7.1%	3.5%	29.5%	1,305
Rank	1	3	5	4	2	4		
2m to ∠5m	6.4%	6.2%	3.9%	2.9%	4.0%	3.3%	26.7%	854
Rank	1	2	4	6	3	5		
5m to ∠200m	12.3%	10.4%	8.2%	6.8%	6.9%	9.5%	54.2%	1,734
Rank	1	2	4	6	5	3		
200m to ∠500m	19.8%	17.3%	7.4%	20.9%	7.4%	13.6%	86.4%	81
Rank	2	3	5	1	5	4		
500m+	19.0%	22.0%	11.9%	22.0%	13.1%	7.1%	95.2%	84
Rank	3	1	5	1	4	6		
All firms	10.4%	7.8%	5.9%	4.9%	6.5%	6.1%	41.5%	4,283
Rank	1	2	5	6	3	4		

†Percentages refer to the proportion of companies audited in each sales band
*N=the number of companies in each sales band

Table 6
Quoted company audits by size (sales bands)

	Proportion (%) of firms audited and rankings†							
Sales (£)	*KPMG*	*Coopers & Lybrand*	*Ernst & Young*	*Price Waterhouse*	*Touche Ross*	*Arthur Andersen*	*Big Six*	*N=**
∠100k	0.0%	7.7%	15.4%	0.0%	0.0%	30.7%	53.8%	13
Rank	4	3	2	4	4	1		
100k to ∠2m	17.1%	13.7%	13.7%	5.1%	11.1%	4.3%	65.0%	117
Rank	1	2	2	5	4	6		
2m to ∠5m	9.6%	13.8%	12.8%	7.4%	6.4%	8.5%	58.5%	94
Rank	3	1	2	5	6	4		
5m to ∠200m	21.3%	14.6%	11.8%	10.2%	8.7%	10.0%	76.7%	1,087
Rank	1	2	3	4	6	5		
200m to ∠500m	19.9%	20.5%	11.3%	17.9%	9.9%	8.6%	88.1%	151
Rank	2	1	4	3	5	6		
500m+	25.4%	19.1%	15.8%	18.7%	9.1%	8.6%	96.7%	209
Rank	1	2	4	3	5	6		
All firms	20.6%	15.6%	12.4%	11.4%	8.8%	9.4%	78.2%	1,671
Rank	1	2	3	4	6	5		

†Percentages refer to the proportion of companies audited in each sales band
*N = the number of companies in each sales band

sub-markets and size ranges may be indicative of product differentiation and audit specialisation (Yardley et al., 1992).

3.3. Market Concentration by Audit Fees

Because of data collection problems, it has been noted (Yardley et al., 1992:174) that few studies have used audit fees[10] as a measure of supplier concentration (Tomczyk and Read, 1989), though auditor revenue is perhaps the most relevant market measure (Moizer and Turley, 1989). Table 7 therefore reports CR6 and individual Big Six market shares for all those companies (n = 100,740) with audit fee[11] data on the FAME database (that is, combining all the sub-markets described in Table 2). The supplier ratios are tabulated across eight audit fee bands (ranging from less than £1k to £1m+), and reveal the same positive associations in CR6 ratios as found with corporate sales revenue. More specifically, Table 7 shows that the CR6 ratio rises from only 13.9% for corporate audit fees below £1k, to 96% for those 151 companies with audit fees exceeding £1m.

The CR6 ratio increases relatively steeply in the audit fee bands between £1k and £50k, from 22.6% to 66.8%. In total, 32.8% of the companies (n = 96,846) with audit fees below £50k are audited by the Big Six, compared with 84.4% for those firms (n = 3,894) with audit fees of £50k or more. CR4 ratios also follow a similar pattern, ranging from 11.1% (less than £1k) to 85.4% (£1m+). Overall, these results are consistent with those based on sales revenue and indicate that, although having a substantial presence in the smaller audit (revenue) sub-market (a 13.9% market share of corporate audit fees below 1k), CR4 and CR6 ratios are positively associated with the audit fee size bands.

Finally, Table 7 reveals that KPMG and Coopers & Lybrand rank first and second respectively across all audit fee bands, with KPMG auditing 3.5% of all clients in the smallest fee range (less than £1k), rising to 27.1% of the largest fee range (£1m+). Comparable figures for Coopers & Lybrand are 2.7% and 26.8%, respectively. Ernst & Young ranks third across all audit fee categories under £250k, but fourth in the two largest fee bands (£250k to £1m+). Price Waterhouse ranks third in both the larger fee categories. Relative to Price Waterhouse, Touche Ross has a higher market share in the smaller audit fee categories (less than £20k), but this position is reversed for the remaining (larger) audit fee bands. This feature of the market is particularly noticeable in the largest audit fee category (£1m+), where Price Waterhouse (ranked third) conducted 16.9% of the audits in this segment, compared with a figure of only 3.3% for Touche Ross (ranked sixth). Indeed the next highest ranked (fifth) auditor (Arthur Andersen) has over twice the market share (7.3%) of the latter.

4. Discussion

A key intertemporal finding of this study was that the CR6 ratio in the quoted sector has continued to rise in recent years, from 20.7% in 1968 (Briston and Kedslie, 1985) to 72.3% in 1991 (Beattie and Fearnley, 1994) to 78.4% in 1994/95. Beattie and Fearnley (1994:314) have posited that both demand and cost factors are associated with this increase: 'On the demand side, ad hoc evidence suggests that the increasingly perceived need for companies to have an auditor with a high reputation...has resulted in the trend in voluntary realignments towards the top tier. Other potential reasons for voluntary realignments include pressure on company management to reduce audit costs, "opinion shopping" and dissatisfaction with the audit partner/team. On the cost side, one can speculate that both economies of scale, and competition for market share in an inelastic market, have produced the recent series of audit firm mergers.'

In relation to the quoted market, a senior partner in a Big Six firm has also recently commented (Verma and Dresser, 1996:8) that 'clients are choosing to move to Big Six firms because companies are becoming increasingly global and we provide a global service.' However, a further key finding of this study was that the Big Six have a substantial presence (58.2% of audits) in the middle market (£5m to £200m sales range) where, as has been noted, due to saturation of the large-au-

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[10] Under the Companies Acts, there is a statutory requirement to disclose the expense for audit and non-audit (consultancy) services (including tax advice) provided by the auditor as separate figures in the annual accounts of UK companies. Nonetheless, there is a possibility that audit fees may include some non-audit service expenses (and vice versa) in contravention of these statutory requirements. However, Chan et al. (1993:772) reported that interviewed audit partners were of the view that '...the disclosed (audit fee) figures have become much 'cleaner' in recent years and could be used with some confidence...'.

[11] As noted in this paper, under the Companies Acts, smaller UK companies may file modified accounts that exempt them from the statutory requirement to disclose audit fees. This, at least partly, explains why only 100,740 (58.6%) of the 171,799 companies analysed in this study disclosed audit fees. However, an examination of the accounts of a random sample of 200 companies on FAME which had not disclosed audit fees revealed that 146 (73%) had filed modified accounts. There was no obvious reason why the remaining 27% had not disclosed audit fees. Potential explanations include data input errors on the FAME database and/or companies failing to disclose audit fees in contravention of the Companies Acts. However, by examining the CR6 ratio (29.7%) of all firms (n = 171,799) analysed in Table 2, and the CR6 ratio (34.8%) for those 100,740 firms that disclosed audit fees, the CR6 ratio (22.4%) for the 71,059 companies that did not disclose audit fees can be calculated. With reference to Table 7, this would suggest that, cet. par., the non-disclosing firms would, on average, have had audit fees in the £1k to £5k category.

Table 7
Market concentration by audit fee bands (all firms)

	Proportion (%) of firms audited and rankings†							
Audit fees (£)	*KPMG*	*Coopers & Lybrand*	*Ernst & Young*	*Price Waterhouse*	*Touche Ross*	*Arthur Andersen*	*Big Six*	*N=**
∠1k	3.5%	2.7%	2.6%	1.6%	2.3%	1.2%	13.9%	8,084
Rank	1	2	3	6	4	5		
1k to ∠5k	6.2%	4.3%	3.9%	2.5%	3.6%	2.1%	22.6%	43,522
Rank	1	2	3	5	4	6		
5k to ∠20k	10.8%	8.2%	7.1%	5.0%	6.0%	4.5%	41.6%	37,354
Rank	1	2	3	5	4	6		
20k to ∠50k	15.0%	13.0%	10.9%	9.8%	8.8%	9.3%	66.8%	7,886
Rank	1	2	3	4	6	5		
50k to ∠100k	18.5%	15.5%	13.4%	12.4%	10.2%	10.4%	80.4%	2,141
Rank	1	2	3	4	6	5		
100k to ∠250k	20.7%	17.9%	15.4%	13.9%	9.4%	10.6%	87.8%	1,140
Rank	1	2	3	4	6	5		
250k to ∠1m	21.9%	19.7%	14.7%	16.9%	9.1%	8.9%	91.1%	462
Rank	1	2	4	3	5	6		
1m+	27.1%	26.8%	14.6%	16.9%	3.3%	7.3%	96.0%	151
Rank	1	2	4	3	6	5		
All firms	8.9%	6.8%	5.9%	4.4%	5.0%	3.8%	34.8%	100,740
Rank	1	2	3	5	4	6		

†Percentages refer to the proportion of companies audited in each audit fee band
*N=the number of companies in each audit fee band

ditee market, the Big Six are seeking to increase their market share at the expense of mid-tier firms (Bruce, 1996). Potential explanations for the relatively high proportion of the audits of small and medium sized enterprises conducted by the Big Six include targeting of advertising to increase market share, predatory pricing[12] and the acquisition of smaller auditors.

Mergers between larger audit firms have contributed to increasing CR6 concentration in the quoted market. In response to increasing competition and recessionary pressures, the evidence also suggests that merger/takeover activity between large and smaller (including mid-tier) audit firms, together with similar activity between medium-tier firms and their smaller counterparts, has accelerated in recent years (Brady, 1992; Welch, 1992; Beattie and Fearnley, 1994). As well as providing a potential explanation for variations in individual Big Six concentration ratios, this increase in audit firm mergers and takeovers is at least a partial explanation for the relatively high CR6 ratios observed in the unquoted sub-markets in this study.[13] The industrial organisation literature (George, Joll and Lynk, 1991:84) has also emphasised the key role of corporate mergers in increasing concentration in UK industry. To the extent that larger companies (predominantly audited by the Big Six) acquire smaller companies (e.g. subsidiaries) and replace non-Big Six auditors in the target, this will also lead to an increase in the CR6 ratio in the market for audit services.

An alternative explanation for high CR6 ratios found in the unquoted markets is that companies are switching to larger auditors. In this context, a managing partner in a (now) Big Six firm commented (Lea, 1990:4) that '...there are those (smaller firms) who realise that perhaps once in a five-year period they are going to need something special and they are prepared to pay for the relationship and quality of services'. However, it has also been argued (Lea, 1990; Wosner, 1996) that smaller auditors offer a more personalised and specialised range of audit and consultancy services to smaller auditees at a cheaper cost—and are therefore well placed to compete against their larger counterparts in the smaller auditee markets.

Other potential explanations for the variations in the market shares of individual Big Six auditors across different sub-markets and size categories identified in this study include audit specialisation and product differentiation. A recent historical study of the UK quoted company audit market (Anderson, Edwards and Matthews, 1996) found that, as far back as 1886, there was systematic evidence that the (then) top six audit firms had engaged in industrial and geographical (including local) audit specialisation. Moizer and Turley (1989) also found evidence of industrial audit specialisation in both 1972 and 1982 in the large (FT500) UK quoted market. It has also recently been reported (Kelly, 1996a) that, to increase market share, Big Six firms are identifying new business areas (market niches) to attract new clients, including the development of specialised legal, consulting and financial services. As well as predicting increased merger activity amongst mid-tier accounting firms to consolidate market share, Kelly (1996b) has also noted that mid-tier firms are increasingly adopting 'niche marketing' and offering specialised client services.

Although this paper has provided some new evidence on concentration ratios in unquoted markets, a key limitation is that it presents a static analysis. The above discussion suggests that productive areas for future research would include an intertemporal analysis of the smaller (unquoted) auditee markets to identify changes in concentration which result from both audit switches and audit mergers.[14] Given the very high CR6 ratios reported in this study for large firms, Big Six firms seeking to increase market share may increasingly target the middle market in the future. Hence its dynamics should be an interesting research area.[15] A further limitation of this paper is that only large audit (Big Six) concentration measures were reported.[16] Future research could extend the current analysis by examining the market shares of mid-tier and smaller auditors across sub-markets and through time. More specifically, an analysis of whether Big Six market growth is at the expense of mid-tier auditors, and/or their smaller counterparts, is worthy of further examination. In addition, concentration ratios in the market for audit services will be affected by the number of newly-created accounting firms, together with accounting-firm exit (e.g. failure) rates, in any particular year. An examination of these aspects of the market for audit services may throw further light on its changing characteristics.

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[12] In this context, Beattie and Fearnley (1995:227) have commented that 'Observed behavioural changes by market participants include tendering, aggressive fee renegotiation and opinion shopping by auditees, and low-balling (i.e. predatory pricing), response to auditees' opinion shopping behaviour and merger activity by auditors.'

[13] That is, by acquiring mid-tier and smaller audit firms, Big Six firms can relatively quickly (compared to organic growth) increase market share in the smaller auditee markets. An historical analysis of Big Six audit firms has also demonstrated that the acquisition of smaller auditors is a key factor underpinning their growth this century (Boys, 1989).

[14] A survey by Page Financial Consultants reported, for example, that 'a growing proportion of small (accounting) practices anticipate selling out or merging' (Jack, 1992).

[15] A further useful extension of the current descriptive study would be to develop multivariate statistical models to identify the factors associated with audit switching in the smaller auditee markets (including switches to, and from, Big Six, mid-tier and smaller auditors). As noted by a referee to this paper, an increase in the rate of smaller companies switching to 'higher quality' auditors may, in an agency framework, imply that agency costs to smaller firms are increasing. An alternative explanation is that agency costs are not increasing, but that larger auditors are discounting fees, and hence smaller auditees may be able to switch to 'higher quality' auditors without initially incurring increased audit costs.

[16] Because the FAME database is updated on a monthly basis, and the data originally collected for this study covered Big Six auditors only, it was not possible to extend the analysis (as suggested by the referees of this paper) to examine the market shares of non-Big Six auditors or changes in the market shares through time. An intertemporal analysis would also have required the purchase of additional FAME discs to enable

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matching of companies at (at least) two points in time. However, since this paper was accepted for publication, the FAME database was extended to include the auditors of each company over the preceding five years. This change to the database will facilitate intertemporal comparisons in future studies.

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Mediating Interests: The Accountancy Bodies' Responses to the McFarlane Report

Anthony Puxty, Prem Sikka and Hugh Willmott*

Abstract—There is now a considerable literature on the significance for accountants of their being accepted as a profession. The claim that they have regard to 'the public interest' in their activities is a central feature of the accountancy bodies' claims to being accepted as a 'profession'. This, they argue, distinguishes them from trade associations and trade unions. The claim is significant for both their economic and symbolic value. This paper examines the accountancy bodies' claims by examining their responses to the 1992 publication of a discussion document *The Future of Auditing* by the Auditing Practices Board. Responses by four major professional bodies are analysed in detail. It is concluded that most of them do not attempt to redeem the claim to have regard to the public interest. Instead, they are mainly concerned to promote their members' private interests, frequently by advocating policy measures that will advance their own members' interests at the expense of those of other accountancy bodies. The significance of the contradiction between the transparency of this advocacy and the considerable effort expended in claiming to act in the public interest is discussed.

1. Introduction

Recent years have witnessed extensive changes in the regulatory, standard-setting, enforcement and disciplinary arrangements of the six main bodies[1] that constitute the UK accountancy profession. Some changes have extended their public role. Following the Financial Services Act 1986, the Insolvency Act 1986 and the Companies Act 1989, the major professional bodies now function as regulatory bodies and quasi-lawmakers that are required to license practitioners and monitor the work of members in public practice. These changes have also increased the visibility of the accountancy function societally. Other changes, such as the transformation of the Accounting Standards Committee (ASC) into the Accounting Standards Board (ASB), may not have directly increased the power of the accountancy bodies, but have probably served to legitimise further the power of accounting practices (Dearing, 1988; Whittington, 1989).

The social standing and privileges of the accountancy profession depend on sustaining the belief that, as a regulator, it should/will keep a certain distance or independence (Sikka and Willmott, 1995a) from what it regulates (i.e. auditing firms) and thereby serve the public interest, an understanding that is regularly reiterated by those who speak for the profession (see, for example, Lickiss, 1990; McNeil, 1992; Plaistowe, 1991, 1992a, 1992b, 1992c; Regulation Review Implementation Working Party, 1996). When responding to public criticisms, claims to serve the public interest frequently permeate the rhetoric of the profession's spokespersons. For example, Ian McNeil (1992), the 1991–92 president of the ICAEW, asserted that 'the ICA is not a trade association; it is at the centre of a profession whose charter speaks of the public interest as the foremost consideration'. In a similar vein, Michael Lickiss (1990), the 1990–91 ICAEW president, has asserted that 'A professional body does not represent its members in the way that, for example, a trade union does...In practically all aspects they [the Institutes] "represent" members merely by making technical representations on a non-political basis'. The public interest also now features in the form of the Charters bestowed on the major accountancy bodies. In the words of the Privy Council Office, Royal Charters are only granted:

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*The authors are, respectively, Anthony Puxty, deceased, formerly of Strathclyde University; Prem Sikka of Essex University; and Hugh Willmott of UMIST. They would like to thank participants at the 1993 Ernst and Young International Accounting Symposium, University of Wales, Aberystwyth, and in the seminar at the University of Leeds, particularly Chris Humphreys and Peter Moizer. They are also grateful for the helpful comments of Ken Peasnell and the reviewers. Correspondence should be addressed to Professor Willmott, Manchester School of Management, UMIST, PO Box 88, Manchester M60 1QD. This paper was first submitted in September 1993 and finally accepted in June 1997.

[1] The Institute of Chartered Accountants in England and Wales (ICAEW); the Association of Chartered Certified Accountants (ACCA); the Chartered Institute of Management Accountants (CIMA); the Institute of Chartered Accountants of Scotland (ICAS); the Institute of Chartered Accountants in Ireland (ICAI); and the Chartered Institute of Public Finance and Accountancy (CIPFA).

> 'when a number of criteria are satisfied, one of which is that the work of the institution so incorporated is in the public benefit'.[2]

In later correspondence, the Privy Council added:

> 'the petitioner shall exist not solely to advance the interests of its members but also, and primarily, to advance the public interest'.[3]

Making such pledges may be comparatively easy. Demonstrating compliance with pledges given in public statements and in their Charters can prove problematic. For reconciliation of the regulatory and sectional roles of trade association is by no means automatic or uncontested (Worsley, 1985; Smith, 1993; Sikka, Willmott and Lowe, 1989, 1991, Willmott et al., 1993; Sikka and Willmott, 1995b). The inherent difficulties are compounded when 'serving' or advancing' the public interest has to be 'seen to be done': the actions of the bodies are increasingly subjected to scrutiny from the press, members of Parliament and academics (see Mitchell and Sikka, 1993; Sikka, Willmott and Puxty, 1995; Sikka and Willmott, 1997). The difficulty of simultaneously pursuing the sectional (or trade union) role of representing their members while, at the same time, being seen to honour the pledges contained in the Charters and other public pronouncements is succinctly captured by the comment that, '[The Institute] cannot be both a regulator and a protector of members. Splitting the function will enable us to at least bridge one expectations gap' (*Accountancy Age*, 21 May 1992, p.3).

This paper focuses on responses from the major accountancy bodies to the Auditing Practices Board's (APB) discussion document, *The Future of Auditing* (APB, 1992). Issued in November 1992 (hereafter the *McFarlane Report* or *McFarlane*[4]), we understand this document to have been prompted in large measure by widely expressed misgivings about the capacity of auditors to fulfil their public interest responsibilities. Responses to this document[5], we suggest, present an opportunity to explore the tensions between the objects of the bodies which are directed at representing the private interests of their members and those that are concerned with the public duty to serve 'the public interest'. To this end, we provide a close analysis of responses to *McFarlane* in which we compare and contrast the position articulated by the accountancy bodies in a number of key areas. Although we offer some discussion of the context in which *McFarlane* emerged, we focus principally on the contents of the responses, and, more specifically, their attentiveness and sensitivity to the 'public interest' significance and implications of issues and questions raised by *McFarlane*.

As our analysis of the bodies' responses to the *McFarlane Report* shows, their comments differed considerably, both in style and content. We propose that these responses can be read as shedding light not only on the bodies' attitudes to issues raised by the report, but also on the positioning of the bodies in relation to the other institutes, and the socio-political context in which they operate. In responding to *McFarlane*, the professional bodies were commenting in the public arena on the proposals of a committee under their own control: the APB is a division of CCAB Limited, which in turn is exclusively owned by the major accountancy bodies. In responding to 'external' requests and pressures, such as the public comments on the *McFarlane Report*, each accountancy body developed a posture towards its contents within the commercial and regulatory space occupied by its members. This space encompassed inter alia audit firms, industrial interests, other accountancy bodies, and the state as represented by (principally) the Department of Trade and Industry (DTI).

Our analysis of the bodies' responses highlights and interrogates some of the tensions and conflicts that arise when, on the one hand, the bodies are expected to represent their members' diverse interests and, on the other hand, have a duty under the terms of their Charters, as well as an incentive in terms of public perception, to honour their pledges to act in the public interest. We conclude that most of the bodies do not attempt to warrant the claim to have regard to the public interest. Instead, their responses to *McFarlane* are overwhelmingly concerned with defending and promoting their members' private interests, frequently by advocating policy measures that are expected to secure or advance their own members' interests at the expense of those of other accountancy bodies. The significance of the contradiction between the transparency of this advocacy and the repeated claims to have 'the public interest as a foremost consideration', as noted above, is explored and discussed.

The paper is organised as follows. As the responses to the *McFarlane Report* are taken as a focus for exploring tensions between the accountancy bodies' 'private' and 'public' responsibilities, we begin by considering the notion of the 'public interest'. We then situate the *McFarlane Report* within the broader context of social and economic developments that led up to its preparation. Next we analyse the responses of four of the accountancy bodies to *McFarlane*, drawing out the way that conflicts between the 'private' and 'public' roles and responsibilities are articulated in the practical discourse of their representations to McFarlane.

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[2] Letter from the Privy Council dated 12 March 1992.

[3] Letter from the Privy Council dated 24 June 1992.

[4] So called because the working party that prepared the report was headed by John McFarlane, a director of Citibank.

[5] The purpose of the *McFarlane Report* was stated as being: 'to promote debate on the future of auditing in the UK and the Republic of Ireland'. In the paper, the APB offers for consideration a number of outline proposals and would welcome comments or alternative views on these important issues. (Auditing Practices Board, 1992, inside front cover).

We have restricted our analysis to responses from just four accountancy bodies—the ICAEW, ICAS, ACCA and CIMA—since 84 responses totalling some 526 pages were submitted to the APB. The ICAEW, ICAS and ACCA are included because almost all UK auditors are members of these bodies. In addition, under the Companies Act 1989, these bodies act as public regulators (known as Recognised Supervisory Bodies or RSBs) of external audits and are thus expected to safeguard the public interest. Although CIMA members (unless they hold memberships of the aforementioned bodies) generally work in industry and do not engage in external audits, CIMA is included in our analysis because it has been actively contesting the territories occupied by auditing firms and has been seeking a 'reporting role' (as distinct from an 'audit' role) for its members. Two CCAB bodies are omitted from our selection. One is the Institute of Chartered Accountants in Ireland (ICAI), which did not respond. The other is the Chartered Institute of Public Finance and Accountancy (CIPFA) which, being concerned mainly with the public sector, has less relevance for the issues addressed by *McFarlane*. Only where directly apposite have we noted CIPFA responses. Since audit firms and other commentators do not have Royal Charters with explicit pledges to serve the public interest, their responses have not been analysed. The final section considers the implications of the analysis for an understanding of the interplay of contemporary accounting discourses.

2. The 'public interest'

In this section we consider three questions. First, how do we conceptualise 'the public interest' for the purpose of analysing accountancy bodies' responses to *McFarlane*? Second, why might we expect to find the professional bodies using the rhetoric of the public interest in their responses to *McFarlane*? Third, are we justified in hypothesising that a conflict exists between the private interests of the accountancy profession and the public interest criterion built into their public statements and Royal Charters?

We begin with the problem of defining the public interest. It can be defined and applied in many ways (Willmott, 1990). We do not propose to work within any specific definition. Rather, we take the (post-structuralist) view that the meaning of 'public interest' (and also 'private interest', for that matter) is rarely, if ever, fixed; and that any meaning ascribed to 'public interest' is continuously subject to challenge and negotiation. We are therefore sceptical about the coherence and value of (logocentric or 'philosophy of presence') efforts to provide a universal, non-negotiable meaning to 'the public interest'. Bracketing this concern to establish and apply acontextual definitions, we are interested in exploring how the concept of 'public interest' is mobilised (or disregarded), explicitly or implicitly, in accounting discourses, such as those articulated by spokespersons of the bodies quoted above, who differentiate their role and concerns from that of 'trade associations' by reference to their wider public interest responsibilities. More specifically, we are interested in how concerns with public responsibilities are presented or absented from discourses by the accountancy bodies to those who make (diverse) demands on them. By avoiding the imposition of our own definition or 'benchmark' of the public interest on the accountancy bodies, we seek to illuminate how its meaning is articulated by the bodies. In other words, we are much less interested here in evaluating the bodies' claims against a privileged criterion of public interest responsibility than in exploring the contents and significance of their claims and responses to *McFarlane*.[6]

We turn next to our second question: why might there be a prior expectation that the accountancy bodies would use public interest rhetorics in their discourses over *McFarlane*? We suggest there are at least four interlinked reasons: their increased legal responsibilities, the increased pressures on them arising from public concerns over audit and other failures, the extensive public criticisms to which they have been subject over the past few years, and the increased visibility that results from these factors. We briefly elaborate on these in this order.

The significance of the bodies' *increased legal responsibilities* is linked to the supervisory role of the DTI and parliamentary select committees. So long as private bodies do not have delegated state power, there is little especial expectation that their actions might be required to be in the public interest. Once they have been granted such powers, they are then accountable to, and potentially under surveillance by, the sponsoring government body and parliamentary committees that are charged with the responsibility for ensuring that they use those powers appropriately. The bodies are then obliged to justify their position on any contested issue by persuading these and other interested observers that they are indeed putting the public interest before their sectional interests.

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[6] To be clear, we are not saying that our analysis of responses to *McFarlane* is 'objective' or 'neutral'. On the contrary, in common with all other analysis, it is informed by particular assumptions and values. For example, we assume that difficulties can be encountered in reconciling what are deemed to be the 'private interests' of the members of accountancy bodies with what is understood to be the 'interests' of a wider public; and our belief in democratic politics leads us to view these difficulties as an important focus for research as well as providing an orientation for collecting and interpreting data on the bodies' responses.

Second, the result of alleged *audit failures* such as Johnson Matthey, Atlantic Computers, Sound Diffusion, Maxwell, BCCI and Polly Peck, has been that the bodies whose members undertook those audits are prone, if they do not heavily discipline or exclude the auditors who undertook those audits, to be accused of favouring the interests of their own members above the interests of those members of the public who suffered. Since the auditors involved in these situations are rarely excluded, or heavily fined (Mitchell et al., 1994; Sikka and Willmott, 1995b), we might suppose the accountancy bodies would reaffirm, particularly when the discourse concerns the audit, that they are concerned to act in the public interest. Regardless of whether the audit industry's private interests are consistent with the public interest, the accountancy bodies risk being perceived as not being so, and thereby become vulnerable to tighter regulation, unless they can compellingly argue that they are.

Third, as a result of the *public criticisms to which the accounting bodies have been subjected* by newspaper columnists and politicians (Mitchell et al., 1994; also see Sikka and Willmott, 1995a, for an indication), it might be expected that the bodies would be concerned to be seen to be paying attention to public interest concerns in their statements. Not to do so might be accepted as tacit acknowledgement that their actions were not in what was perceived to be the public interest, thus risking further calumny.

Finally, there is the increased *visibility that arises from all the above factors*. It has widely been remarked that at one time the accountancy bodies were publicly all but unnoticed (cf. Zeff, 1972). In such a situation their official responses to a document by an audit regulatory body might go unremarked. In the public spotlight, their statements are now prone to be examined carefully by the press and others. Thus it is to be expected that they would guard against what might be construed as special pleading in their public statements.

We now turn to the third topic of this section: whether or not we might assume that private interest and public interest coincide. We do not believe that the two interests are obviously consistent any more than we believe that the so-called 'expectations gap' can be bridged (Sikka, Puxty, Willmott and Cooper, forthcoming). Equally, to repeat, we are not seeking to evaluate the claims of the accountancy bodies against some essential or universal benchmark of what 'the public interest really is'. Instead, we are assuming that public comment by the accountancy bodies (e.g. responses to *McFarlane*) are formulated within a 'space' that prompts some attentiveness to 'public interest' considerations. We assume only that public statements by accountancy bodies will be informed, amongst other considerations, by some concern for their credibility as guardians of the 'public interest'. For if the DTI or any other significant observer perceives statements issued by these bodies, such as responses to *McFarlane*, to be against the public interest, this is potentially damaging to the (private interests of the) accountancy bodies. What is significant, for our present purposes, is that, having public responsibilities under their Royal Charters, and in the light of increased legal responsibilities, audit failures and public criticisms, the accountancy bodies, we conjecture, are increasingly under pressure to articulate their concerns in a way that is ostensibly consistent with whatever powerful or influential others deem to be 'the public interest', and might therefore be expected to use arguments that can be claimed to anticipate and assuage such sensitivities.

3. The context and content of the *McFarlane* report

3.1. The Context

The late 1980s and early 1990s have been marked by an increasing visibility of the external audit function, often in the aftermath of some well-publicised corporate collapses and frauds, such as the Bank of Credit and Commerce International (BCCI), Maxwell, Polly Peck, Barlow Clowes, Levitt and others. Such failures had an impact not only on investors, bank depositors, pensioners, creditors, employees and other stakeholders, but also on government policies (Bingham, 1992). In such an environment, journalists, politicians and academics have asked searching questions about the value and relevance of external auditing practices (Freedman and Power, 1992; Sikka and Willmott, 1995a). For example, some commentators have argued that 'The profession has never been less credible. It's seen to be accountable to no one' (*Time* magazine, 16 March 1992, p.62); 'People are extremely concerned about the way in which auditors are operating and the way in which the reports they produce are serving the public' (*Accountancy Age*, 12 December 1991, p.1). Major newspapers have doubted auditors' claims of being independent watchdogs (*Financial Times*, 4 October 1990, p.24; *The Times* 10 February 1992, p.13). Some have blamed self-regulation for auditing laxities (*The Guardian*, 27 September 1990, p.11; *The Observer*, 6 January 1991, p.27; *The Economist*, 17 October 1992, pp.25–28). One major newspaper carried an editorial arguing that 'it's absolutely pointless for companies to employ auditors or, indeed, provide audited accounts'

(*The Independent on Sunday*, 6 October 1991, p.11).

Despite these very public criticisms, the state's scrutiny of corporate governance (of which audits are a part) has been perfunctory.[7] Although, as a consequence of the recommendations of Lord Justice Bingham (Bingham, 1992), the government imposed a statutory 'duty' on financial sector auditors to report fraud to the regulators, there has been no legislative or government-led scrutiny of the role, relevance and accountability of auditors, or their institutions.[8] A laissez-faire approach has left the field open for action by the accountancy bodies.

Within the above context, the Auditing Practices Board sought to restore confidence in external auditing by commissioning the *McFarlane Report*. The report began its life in early 1992 when the APB formed a working party[9] chaired by Citibank director John McFarlane. Various individuals were invited to make contributions to its deliberations. These contributions went through various 'filters' and 'private' discussions within the APB, the details of which are not on the public record. The resulting report was favourably received by the press and described as 'radical', requiring a 'fundamental redefinition of auditing's relationships' (*Accountancy Age*, 26 November 1992, pp.1–5); *The Guardian*, 24 November 1992, p.12; *The Times*, 24 November 1992, pp.22 and 25; *The Independent*, 24 November 1992, p.23).

3.2. The Content

In essence, the *McFarlane Report* is a discussion paper that is more concerned to raise questions than to offer explicit solutions.[10] Nevertheless, its preferences on most issues are stated.[11] The report opens with a list of others' perceptions of the audit that the APB does not necessarily endorse. These are: that there is an expectations gap between the role people expect of auditors and what they do; that auditors are insufficiently independent of those they audit; that auditors' reports are insufficiently informative; that the quality of audit may have been compromised by cost-cutting (lowballing); that the improvement to audit has been hampered by excessive litigation; that audit regulation is insufficiently independent; and that the training of auditors is inadequate. This list is followed by six main sections.

Redefining the role and scope of audit. There is a proposal that the audit must be redefined to include additionally (a) a report on the conduct of a company's affairs by its management, including comment on the adequacy of internal financial controls and corporate ethical standards; there is also a less specific proposal to respond in some way to public demands that auditors comment on irregular acts (fraud); (b) a longer ('non-stereotyped') audit report that summarises the assumptions and judgments made in preparing the financial statements, and one that comments on a broader range of information contained in the annual report; (c) a comment on any substantial future risks attaching to the company. Finally, it is proposed that there should be debate on the extent to which auditors might report to a broader constituency of stakeholders than only shareholders.

Enhancing auditor independence. More active participation by shareholders is to be encouraged (possible mechanisms are suggested), as are audit committees. The document is uncommitted on the question of fixed-term appointments for auditors, but raises the issue. Similarly, it indicates concerns over auditor independence caused by the provision of non-audit services to their clients by audit firms, suggesting that greater involvement by shareholders (see above) and review panels might constitute a solution. Some concept of 'trustees' is also introduced to resolve the question of the interests of non-shareholder stakeholders in the audit.

Mitigating the effect of litigation. Here the recommendations of the DTI's Likierman report are quoted, and subsequent developments briefly discussed. The APB does not express a preference among these, but urges urgent consideration of what might be done, especially if auditors are to have responsibility to all stakeholders.

Becoming responsive to change. This section lists requirements as follows: that the audit profession must resolve current issues as described earlier, develop training in audit skills, anticipate future developments, change its systems of governance to enhance its responsiveness to change, and set its longer-term priorities—the APB proposes to publish a set of longer-term goals for its work programme.

Proposed next steps. This section lists the items above on which it would particularly like to receive comments. The document ends with an appendix that, over three pages, summarises 'The enduring principles of auditing'.

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[7] Indeed, the third reading of the Companies Act 1989 was guillotined by the government (see Cousins and Sikka, 1993).

[8] At the time of writing, no government (e.g. DTI) or profession-led report has been published into the conduct of audits at BCCI, Maxwell, Levitt or Polly Peck.

[9] Full membership is not known, but from the press reports it can be deduced that partners of major firms such as Coopers & Lybrand were represented on it.

[10] Public comments were invited on the report's proposals by 31 March 1993; these were subsequently examined by another working party formed by the APB and eventually resulted in a successor publication, *The Audit Agenda* (APB, 1994). The contents of this report are not analysed here.

[11] Firms such as Coopers & Lybrand, KPMG and Ernst & Young expressed some disquiet with the APB's approach and preferences (*Accountancy Age*, 26 November 1992, p.1; 28 January 1993, p.12; 25 March 1993, p.2).

Table 1
The length of responses from the accountancy bodies

Accountancy body	*Pages*
ACCA	7
CIMA	11
ICAEW	14
ICAS	3

4. The *McFarlane Report* and an analysis of the Institutes' responses

4.1. Competing Jurisdictions

Before examining the accountancy bodies' responses to the *McFarlane Report*, it is appropriate to appreciate the diverse nature of the UK accountancy profession. The bodies differ considerably in terms of size, social constituencies, influence and financial and political resources (Willmott, 1986; Puxty, 1990). The combined membership of the six major bodies is around 234,000[12] (*The Times*, 14 November 1996, p.33). Their members work in corporations, government offices and accountancy firms of various sizes, performing a variety of functions ranging through auditing, accounting, taxation, consultancy and insolvency. The diversity of membership and its competing organisational, professional, business and personal aspirations and anxieties are potential sources of tension and conflict. The internal segmentation means that policies that are deemed to be in the interests of some members of any given body may not be perceived by other members to be in their interests. Policies favoured by (a dominant segment of) one body can be threatening to the values and priorities of members of other bodies, and thus lead to tensions and conflicts amongst bodies that are often anxious to present themselves as members of a cooperative federation who experience the minimum of difficulty in speaking with one voice.

At the heart of the difficulties within and among the bodies is their competitive effort to secure, extend and enhance the markets for their members' labour (Willmott, 1986; Willmott et al., 1993). These difficulties surround the continuous process of differentiating and distancing themselves, as 'professional bodies', from 'trade associations'.[13] Whereas a trade association is deemed to be formed solely for purposes of furthering the private interests of its members, a profession aspires and purports to be committed to standards of behaviour that have regard to the public interest rather than solely to the private interests of its membership.[14] The conflict between private and public interest is often managed by appealing to a well established aura of professionalism under which the profession reassures the public that it always prioritises the public interest over its private interests. Evidence for this is not hard to find. For example, Ian Plaistowe, the 1992–93 president of the ICAEW, claimed that 'As an institute, we see our primary role as being to serve the public interest....If we are not regulating our own affairs in the public interest we might as well be a business, not a profession' (Plaistowe, 1992b). Associations that can become accepted as professions enjoy a privileged status when negotiating influence over their territories and domains, and are in a position to secure higher rewards in the labour market (Abbott, 1988). Because of the composition of their membership and their perceived interests, the accountancy bodies are engaged in political processes of negotiation and domination through which they seek to influence and control the material and symbolic conditions of the exchange of their members' labour. In practice, the difficulty in advancing such 'interests' (however conceived or defined) is compounded not only by problems of communication, integration and regulation but also by patterns of sponsorship and control within and among the bodies.[15]

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[12] This number may be inflated, as some accountants are members of more than one accountancy body.

[13] A significant feature of the discourses surrounding the accountancy bodies has been the sobriquet 'profession'. This term is the subject of an extensive literature in sociology (cf., for example, Millerson, 1964; Larson, 1977; Johnson, 1982; Wilding, 1982; Abbott, 1988) and accountancy (e.g. Mautz and Sharaf, 1961; Montagna, 1974; Richards, 1984; Previts, 1985; Flint, 1988). This literature parallels and implicitly legitimises much professional discussion about the professional status of accountancy and, more particularly, the extent to which it displays the distinctive (idealised) traits that are deemed to legitimise its claim to be a 'profession'.

[14] From this it does not follow that they necessarily know how best to achieve this, or that they are in a position to secure desired outcomes.

In sum, when interpreting the responses to the *McFarlane Report*, it is also relevant to be mindful of the positioning of the bodies in relation to each other, since they compete for members in relation to markets; their members compete for business; and, in relation to the state, they all compete for status and legitimacy. The discourses contained in responses to the *McFarlane Report* are then understood to be illustrative of processes through which power is exercised, interests are expressed, positions are declared, and actions come to be taken.

4.2. Forms of Responses

The form and length of the bodies' responses to *McFarlane* vary considerably, as do their presentation. Table 1 provides a brief description of the length of the responses. The ICAS submission comprises three sheets of A4 stapled together.[16] The ICAEW issued its official[17] response as a technical release (FRAG 5/93) and accompanied this with a letter from the president, and a two-page press release. CIMA's response also appears to have been a stapled set of papers.[18] The ACCA response took the form of a bound booklet, its first page being an executive summary and the second page presenting detailed recommendations before the commentary proper.[19]

We have summarised much of the detail of the substantive content of the responses in Table 2. Due to lack of space, this does not pretend to be a full synopsis of the arguments made. It is intended instead as a guide to the salient points expressed, which may help as the following analysis proceeds.

The four bodies' responses are nominally linked to questions raised by the *McFarlane Report*. However, the detail, length, extent and tone varies considerably. In some cases, the four professional bodies disagree with the implicit tone of *McFarlane's* phraseology. In other cases comments are made that might be considered, especially by those outside the profession, contentious, but were apparently considered to be unproblematic by the respondents. One such example is the ICAEW comment on what it supposes to be misperceptions on the part of the public as to the role and/or the adequacy of the activities undertaken by the accounting institutions (the 'expectations gap'). The ICAEW remarks:

> 'The paper is founded on a number of perceptions said to reflect concerns about the current state of auditing. We accept that if they exist these perceptions must be changed and that ways must be found of changing them' (ICAEW;1;2).[20]

The ICAEW response does not discuss whether or not the public's perceptions are correct (the response does not refer to misperceptions, but perceptions). It also seems to be taken for granted that the perceptions rather than the actuality should be changed, and that the APB will share this view; the passage above uses the expression 'we accept that', in a manner that implies that *McFarlane* suggested that the perceptions should be changed, which, in our view, it did not.

Despite some commonalties, there are, we contend, noticeable differences in the submissions, as our analysis will show. The ICAS submission addresses few of the questions raised by McFarlane. The ICAEW response is cautious and broadly supports the status-quo. While seeking concessions/reforms on auditor liability, the latter is not too keen to have auditor duties and scope of responsibilities widened. It particularly defends the accountancy firm's ability to sell consultancy services to audit clients. The ACCA response begins by recognising the needs for change in a new environment and to broaden the audit debate. But unlike the ICAEW, it seeks to defend small company audits. However, the ACCA response is also opposed to the extension of audits to areas concerning propriety, effi-

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[15] For example, around 33% of the ICAEW's membership is in public practice (ICAEW, 1993), but around 75%–80% of the Council comes from this wing (1993–1995 annual reports).

[16] The ICAS submission is especially brief, perhaps because it was already planning a document that has since been published, *Auditing into the Twenty-first Century* (ICAS, 1993). The latter document has not been analysed in detail because it constitutes a discussion document of the institute's research committee, contains disclaimers as to its representation of the institute's council's views, and thus cannot be said to have the imprimatur of the response we have considered, which is the work of the ICAS.

[17] There were two additional responses from constituencies of the ICAEW: one from its Audit Regulation Policy Co-ordinating Committee, the other from the London Society of Chartered Accountants. Neither refers to the 'official' response, or demonstrates any awareness of the official ICAEW response.

[18] These are the forms of the responses as they were sent to us. It is possible that some bodies provided us only with photocopies of responses that were sent to the APB in a different form.

[19] In April 1994, the ACCA issued an additional statement, this time opposing the proposals for reforming auditor liability. Subsequently, it called for replacement of joint and several liability by full proportional liability (*Certified Accountant*, June 1996, p.7).

[20] In the remainder of this paper we shall use this uniform referencing system for the four institutional responses. There are three terms separated by semi-colons. The first is the institution making the response; the second is the page number; the third is the paragraph number on that page. This uniformity has had to be imposed because the documents themselves vary in their systems. ICAS uses no system; ICAEW refers specifically to *McFarlane* paragraph numbers; CIMA and ACCA use a simple sequential numbering system.

Table 2
Synopsis of accounting bodies' responses to *The Future Development of Auditing* (the McFarlane Report)

	ICAS	*ICAEW*	*ACCA*	*CIMA*
Problems of public perception of audit ('expectations gap')	No comment	Complex response that argues a way should be found to change these perceptions [1; various]; [5-6; various]. APB should have stated its position on these perceptions [5; 2]	'The present peceptions...are unpalatable, but it is naive, if not disingenuous, to suggest that they are ill-informed, with the corollary that a public education exercise is needed rather than reform of the profession' [3;2]. Argue a broader-brush approach should be taken given the changes of recent years [2;2]; [3;6]; [4;1]. 'We accept that proven short-comings on the part of external auditors may not have always resulted in tough and appropriate disciplinary action' [4;4].	There needs to be common understanding of the purpose of the audit; its judgmental nature needs to be better communicated [5;8].
Audit should be more forward-looking	Agree [2;1]	By its nature 'the audit is backward looking because historical accounts are historical' [8;4]. Have commissioned research and accept that stakeholders in the company could benefit from predictive information [8;4].	No specific comment	No specific comment
Audit should comment on proper conduct of business	Disagree, especially in respect of 'wider aspects of corporate accountability and ethics' [2;2].	'The auditor cannot be expected to give positive assurance that there has been proper conduct, but only to report on the absence of knowledge of improper conduct' [7;1]. 'There should be a clear distinction between propriety and efficiency' [7;3]. We...believe the assertion...that it is realistic to expect auditors to monitor basic ethical standards of corporate behaviour, is over simplistic [7;5]	'The scope of the external audit should not be extended into areas concerning the propriety, efficiency or ethics of the management' [2;6]. The benefits are not clear...This is the domain of management. The market rewards or punishes. Diffficult to get objective measures of propriety. Ethics are even more difficult territory [5;3].	Benchmark needed for reporting on ethics of action; 'auditing against this would be possible but to whom would it be of value?' If acts are not illegal, who would be interested and what actions should be taken? [7;2]. 'There seems little point in asking auditors to review for any significant illegal act, financial or not...the auditor cannot and should not take on the role of policeman in areas outside finance [8;1].

	ICAS	*ICAEW*	*ACCA*	*CIMA*
The auditor should be associated with more than just the formal financial statements.	No specific comment.	Accept that auditors 'should be prepared to be associated with a wider range of information' but 'there are dangers in extending auditors'responsibilities beyond the financial sphere' [8;2].	The objective (to discover weaknesses that could lead to loss or failure) is better achieved where there is an effective internal control function and internal audit [4;6].	External audit 'should not expand its involvement beyond reporting on financial performance, financial controls and financial aspects of corporate governance' [1;5]. However, 'we support the extension of audit review to cover a wider range of published financial information although at a lower level of assurance than for the annual financial statements' [8;2].
Extension of responsibility from shareholders to stakeholders.	Agree it merits attention; but difficult to achieve in the short to medium term [@] [2;3].	Express concern; proposals seem 'burdensome and bureaucratic and in some cases unworkable'; no obvious tangible benefits; but 'do accept that other stakeholders' needs should be taken into account when defining the auditor's role'. Strongly oppose responsibility to Inland Revenue [10;3,4]. And they see no need for stakeholder 'trustees' [13;2].	'Concerned that any widening of the definition of "user groups" will increase the risk of litigation against auditors' [1;4]. The extension from adding credibility to financial statements to checking/encouraging the proper conduct of business in the public interest may well be essential to justify the continuing description of accountants as 'professionals' [6;4].	Reports to other stakeholders would be costly; companies might not wish to pay it; the benefits are unquantified [8;2]
Greater involvement by shareholders in the audit process.	Agree, but foresee major practical difficulties. Few exercise the rights they currently have [@] [2;4,5].	'We applaud the principle' but this is 'approaching the problem from the wrong side'. More channels for independence of auditors needed; and 'auditors need to be able to turn more easily to some form of company "regulator" when companies try to exert undue pressure' [12;4]. As to an 'audit panel', this is intriguing but too undeveloped for detailed comment [12;5]. No support for 'shareholder representatives'. That is what the directors should be [13;1].	Desirable, but little sign that institutional shareholders are willing to be involved. Practical difficulties are envisaged, but this should not obviate the *principle* concerned. The onus is on the shareholders themselves [6;6].	'These proposals are unrealistic' [10;6].

Table 2 ***(continued)***

	ICAS	*ICAEW*	*ACCA*	*CIMA*
There should be an acceptable balance between costs and benefits of any changes.	Agree [@] [3;1].	Agree; but the APB is 'vague' about the benefits and beneficiaries of changes [10;5].	No specific comment.	No specific comment.
Smaller companies and similar may be treated differently from those McFarlane is mainly concerned with.	Does not believe elaborate reporting requirements are appropriate to smaller companies. Refers to earlier policy document on replacing audit with an annual accountant's report [3;1].	'Categorically oppose two-tier standards, but believe that companies up to a certain size should be allowed to dispense with a statutory audit' [4;4].	'The proposals regarding the extension of the scope of the audit should apply to the audit of all enterprises, regardless of size' [2;1] [3;6].	The vast majority of small companies are not public interest companies, so would fall outside the remit of the proposed Audit Commission [5;3]. Compulsory small company audit should be made optional [5;6].
Potential litigation.	This is one of two key areas that must be addressed so that McFarlane can be implemented. You cannot expect auditors to comment on matters such as future prospects unless their susceptibility to litigation is changed [2;1].	This is 'a barrier to change and to the positive reporting which the market expects. It encourages defensiveness - and could develop into the introduction of risk management procedures that would act as a barrier to the free market' [6;1]. Urgent changes to the law are needed [13;3].	The government should review the Likierman Report for possible means to limit auditors' liability [2; 10];[7;2] Auditors need to be protected against the 'deep pocket' syndrome while firms displaying incompetence or negligence should still be able to be sued [7;2].	A prerequisite for effective external audit is that the auditors have some 'statutory protection from litigation when expressing their opinions, subject to their adherence to professional standards' [2;7].
Detecting and reporting fraud.	Not specifically addressed.	Support call for further research. 'In our view it is essential that auditors are given a regulator, preferably the DTI, to whom they can report or discuss suspicions of fraud, and who can be relied on to act swiftly' [8;1].	No specific comment.	'Responsibility for detecting fraud rests with the management'...if the auditors think there is a prima facie case of fraud, and have gone through all other channels (listed earlier in the CIMA document), 'they should be *entitled* to report this to the appropriate regulatory authority' [6;2].
Fixed period of appointment for auditors.	No specific comment.	The idea is 'misconceived'; no evidence that such is helpful in practice; will not create more robustness in auditors, only costs and upheaval for companies; and higher risk of audit failure in early years after change [11;6].	No specific comment.	No specific comment.
Rotation of audit partners or audit firms.	No specific comment.	Has issued proposals for the former; opposes the latter (no reason provided) [12;1].	No specific comment.	No specific comment.

	ICAS	*ICAEW*	*ACCA*	*CIMA*
Provision of non-audit services by the auditor.	No specific comment.	There is no evidence that this might be harmful [12;2].	'Clearer guidance should be given as to how services may be provided to an audit client without undermining audit independence' [2;9]. There are strong arguments for continuing to permit these arangements, but auditors have to be seen to be independent as well as being so [6;5].	'Complete regulation for external auditors would require that... firms should not be able to provide any services other than audit to a company' and CIMA is in favour of this [3;5,7]. Companies would be required to certify to this effect each year [3; 8].
Excessive dependence of an auditor on one client.	No specific comment.	Agree with APB that disclosure and a defined limit constitute sufficient protection; is considering reducing 10% level [12;3]	No specific comment.	No specific comment.
The general idea of extending auditors' responsibilities.	No specific comment.	'It is necessary to address the commerciality of the audit function, to ensure that auditing remains commercially viable' [1;5].	'Any increase in business risk may lead practitioners to withdraw from auditing altogether' [1;4].	No specific comment.
Transparency of APB's procedures.	No specific comment.	No specific comment.	'The APB should institute a more genuine "sunshine" policy in order to improve public understanding and support for its proposals' [2; 11].	No specific comment.
Auditing and accounting as bases for appropriate skills needed.	No specific comment.	No specific comment.	Training as an accountant in public practice may not be the best training for an auditor. Other skills may be needed (e.g. strategy, management). The ACCA syllabus has already addressed this. Subject to this, accounting and auditing 'should continue to be parts of the same profession' [4;2].	Because of the pace of change 'there is an enormous education and training requirement for external and, indeed, internal auditors'. There should be more investment in training and developing auditors [6;4].
Appropriateness of APB to be the regulator.	No specific comment.	No specific comment.	No specific comment.	The regulatory regime should be independent of the professional bodies [3;9]; this might fall under the aegis of the FRC. It would replace the APB, those who register auditors, the ethics committees, and the JDS [4;1-5].

Notes: [@] Further research recommended. [n,m] page n, paragraph m of the relevant body's response.
This table cannot capture the complexity of responses; some are more specific in their structure than others; some make points more subtle than we can possibly summarise.

ciency or ethics of management. CIMA is keen to see a separation of the auditing wing of the profession from the rest. It is opposed to the provision of non-auditing services by auditors to audit clients. Unlike the other professional bodies, CIMA questions the regulatory structures in place and suggests that the APB be located outside the profession under the aegis of an independent regulatory body. Its response devotes considerable space to filling out the broad contours of its regulatory proposals.

5. The responses

5.1. *The ICAS Submission*

The ICAS submission does not respond to many of the points in *McFarlane* at all (see the ICAS column of Table 2 for the frequent recurrence of no specific comment). However, it does provide its 'views on the matters on which the APB requested particular comment' over the second and third pages. Two specific areas are identified as 'key issues which must be addressed' for the other proposals to be feasible: active shareholder involvement and a limit on the auditor's exposure to litigation. On the issue of shareholder involvement, the ICAS response singles out 'bodies representing institutional shareholders, such as the Association of British Insurers and the National Association of Pension Funds to consider the issues arising from the paper' (ICAS;1;7). It also refers to the environmental power structure:

> 'This corporate environment is the responsibility of many, in particular the shareholders, the management and government. Unless all these parties accept their responsibilities in relation to these proposals, little progress can be made' (ICAS;1;6).

ICAS takes the view that the auditor's role is currently given and is beyond discussion. Although it acknowledges that a widening of the audit's scope is desirable, this is said to be conditional on the resolution of the litigation problem, and only then 'if perceptions of the auditor's role can be corrected' (ICAS;2;1). This defines a limit to change. The paragraph as a whole, as already noted, suggests that the ICAS is willing to welcome change but, like the ICAEW (see below), it is unwilling to countenance a change in the auditor's responsibility. 'Auditors must not be regarded as underwriters of the entity, as currently seems to be the case' (ICAS;2;1).

Towards the end of the ICAS submission there is a claim that, if institutional shareholders will not take extra responsibility and the government will not ease the auditor litigation problem, then 'there will be extensive debate and tinkering but no fundamental changes in practice' (ICAS;3;5). It foresees both as unlikely, in which case 'the proposed extensions to the scope of the audit and enhancement of auditors' independence will make little if any progress' (ICAS;3;5). The subtext of this statement appears to be one in which the institute and other accountancy institutions such as the APB would be unable or unwilling to lead other institutions whose interests might be perceived to be threatened by radical proposals. It is, we submit, a tacit acknowledgement of the extent to which the policies of the institute are governed by the socio-economic interests of its members. This interpretation is supported when, in negotiating the conflicting meanings of, on the one hand, *Caparo*[21] and on the other, claims against auditors that have been successful in court or settled out of court, ICAS makes no mention of the former but it emphasises the latter, and commends change that will reduce auditor liability.

5.2. *The ICAEW Submission*

The ICAEW submission is, according to the president's letter accompanying it, the result not only of its own deliberations but also of 'wide soundings that we have taken of our members both from the business and auditing sectors of the profession'. Like ICAS, the ICAEW president expresses himself as 'delighted that you have enabled public discussion to take place', and the document itself 'congratulate(s) the APB for its initiative and boldness in attempting to create a visionary agenda' (ICAEW;1;1).

At the heart of the ICAEW's response is a concern that:

> 'to extend auditors' responsibilities successfully it is necessary to address the commerciality of the audit function, to ensure that auditing remains commercially viable. Although auditors' increased exposure to risk may not necessarily result in a contraction in the supply of auditing services, it could well be the case that without some formal protection, audit firms would take up a more defensive and thus less useful form of reporting in these circumstances' (ICAEW;1;5).

This illustrates the difficulty the institute faces in its role of representing its members' interests. The institute wishes to protect its member firms[22] from certain risks. To make this acceptable to the public, the reduction of risk is presented as something that is in the public interest, and not solely in the interest of the audit firms themselves (see Gwilliam, 1992 on this). In other words, the interests of the auditing firms and the interests of the public are said to coincide. However, to achieve this, the institute has to argue that the firms themselves are not prepared to act in the public interest when their economic interests are threatened, and acknowledges that firms would then put their own interest before that of the public. Thus, although the institute is arguing that it wishes to place the public interest foremost in its concerns, its argument necessitates the acknowledgement that its own members, who themselves are chartered accountants and hence are in principle bound by the public interest criterion, would transgress and even jettison this principle were their commercial interests to be threatened.

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[21] This refers to *Caparo Industries plc v Dickman and Others* [1990] 1 All ER HL 568 that severely limits the conditions under which auditors are liable to shareholders for their misstatements.

[22] We are aware that audit firms and members in practice are regulated by the recognised supervisory bodies. However, this is a useful shorthand to indicate the fact that the interests of audit firms are wholly intertwined with the interests of the partners of those firms.

Similar concerns are expressed in the institute's comments on auditor independence:

> 'We believe that the public could be given greater assurance of audit independence if more detailed guidance were made available for audit committee members to use in assessing the quality of audits and the independence of auditors. Guidance should include the questions that members of audit committees should ask concerning the internal controls that audit firms operate on independence and quality issues and concerning the standards to be expected from auditors' (ICAEW;3;3).

The response affirms the basic integrity of the audit process. The institute has no doubt that auditors will undertake work of high quality; it suggests the questions that members of audit committees should consider to reassure the fact of the appearance of auditor independence.[23] This view is affirmed when the Institute states that:

> 'audit committees are potentially helpful in strengthening the apparent independence of auditors' (ICAEW;11;5).

That is, the significant feature is the sign of auditors' independence; even 'potentially', the best that can be managed is to strengthen apparent independence. With respect to auditor independence, the ICAEW response opposes fixed-term appointments for audit firms ('Fixed terms will not lead to greater robustness on the part of auditors' (ICAEW;11;6)—although no justification is provided for this statement) and rotation of auditors ('we do not support the rotation of audit firms' (ICAEW;12;1)—no supporting reasoning is provided). The institute supports audit firms' being permitted to provide other services to client companies, without any 'additional safeguards' (ICAEW;12;2)[24] on the ground that 'there is no evidence—for example, in DTI inspectors' reports—that auditors' objectivity is compromised by the provision of other services' (ICAEW;12;2). Such claims ignore the fact that some DTI inspectors' reports have explicitly linked audit failures with the loss of independence due to the provision of non-auditing services (DTI, 1976, 1979).

The institute does agree that the upper limit on fees that firms can receive should be reduced from the present 10% (for firms auditing listed and public interest companies) to 'somewhere between 5% and 10% of the gross income of the firm, taking account of work for clients connected or associated with the audit client' (ICAEW;12;3). However, to put this in context, the UK's major six firms audit around 70% of all quoted companies, and their combined income is around £2,820m (*Accountancy*, July 1994, p.14). Of these firms, Coopers & Lybrand earned £560m and Touche Ross £342.5m. This renders the 5% irrelevant to the major firms: few if any clients are likely to provide firms such as Touche Ross with fees of £17m–£34m.

The institute is particularly opposed to proposals for 'reporting to a wider interest group' (ICAEW;10;2). In particular, the ICAEW opposes any reporting obligation to the Inland Revenue and Customs & Excise. The opposition is justified by arguing that the obligations would be 'burdensome and bureaucratic and in some cases unworkable', though no details or examples are provided. It could be argued that such obligations may help auditors to manage the 'expectations gap' and even help tax authorities to be more efficient in collecting taxes and making savings on the public purse. Not only does the ICAEW seem to assume that auditors will not be able to pass on the additional cost of this work to their clients, but that this change would conceivably broaden their responsibilities and with it the possibility of litigation. Seemingly, it is on private economic costs ground that the institute rejects auditor obligations to wider interest groups.

The institute accepts that 'stakeholders in the company could benefit from predictive information' (ICAEW;8;3), but such matters are assumed to be the management's responsibility. Overall, the institute is cautious and opposes the inclusion of financial forecasts and projections in annual reports on the grounds of cost and disclosing sensitive competitive information to rivals. While acknowledging some auditor responsibility for reporting on 'going concern' issues, the institute has reservations about extending the auditor role in a direction that might require auditors to comment on management imprudence. It fears that, under the weight of additional surveillance, risk-takers may become risk averse; and it concludes that 'nothing should be done to create a climate in which business risk is discouraged, since this is fundamental to business activity' (ICAEW;9;3). Thus public interest is defined in terms of encouraging risk-taking rather than giving account of that risk to various interest groups, or enabling the user groups to make a judgment of the risks being placed on them by management.

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[23] It is thus supposed that, without guidance, audit committees might not be aware of the questions they should ask in order to reassure the public: guidance on these questions is therefore to be provided (the institute does not say by whom).

[24] CIPFA's response points out that in the public sector, auditors are appointed by the Audit Commission; this 'has adopted and implemented, a rotation policy'; and it has a code of practice that 'sets out clear rules on the provision of non-audit services by an auditing firm (subject to a de minimis limit of £10,000 in total each financial year)' (CIPFA;4;10 et seq.)

On the matter of auditors' checking on management's 'proper conduct', the institute is cautious. It is here that one feature of the difficulty of defining the public interest becomes especially significant. One might suppose from other institute pronouncements that ethical conduct is in the public interest. One might also suppose that the financial success of UK multinational companies is in the (UK's) public interest. These, it is suggested, can conflict when multinationals operate in countries where bribery is common or institutionalised. The problem is resolved in terms that treat the public interest solely in language that appeals to the desire for the unimpeded pursuit of business opportunities:

> 'Some practices regarded as normal in certain parts of the world would not be readily accepted in, for example, the UK or the US. We believe that the US Corrupt Foreign Practices Act may have created difficulties for some large US companies, and concomitant problems for auditors' (ICAEW;7;6).

Here, the public interest (served by the success of UK companies abroad) is argued to be consistent with the interests of the institute's constituent interest group, the multinationals' auditors. The morality of the affair is elided; actions that might make more money for UK companies could make the auditor's task more difficult, a problem that can be resolved by avoiding the proposal that auditors should comment on the proper conduct of management.

5.3. The ACCA Submission

In contrast with the ICAEW response, the ACCA submission is constructed around the acknowledgement that there might be faults with the auditing process and auditors. On the public's expectations of the audit, it comments:

> 'The present perceptions...are unpalatable, but it is naïve, if not disingenuous, to suggest that they are ill-informed, with the corollary that a public education exercise is needed rather than reform of the profession' (ACCA;3;2).

The ACCA suggests that to restore confidence it may well be necessary to take action that goes beyond efforts to 'correct' public perceptions. It is recommended that debate should focus on two main issues:

> 'What must be done to address public dissatisfaction as expressed by some journalists, academics and members of Parliament';
> and
> 'What external audit role is required now and is likely to be required, and how this can best be developed to serve the public interest in the future' (ACCA;3;4–5).

Since few ACCA members are partners in the multinational accounting firms that audit most public companies, there is little pressure on its officers and spokespersons to develop a response that defends or promotes these firms' activities. However, many ACCA members are involved with small company audits. Unlike the ICAEW, the ACCA response favours the continuation of the small company audit, but commends that it should continue with all the extensions proposed by the APB. Noting that *McFarlane* was produced in the context of public and public interest companies, ACCA observes that:

> 'Some commentators say this renders much of the paper irrelevant to the vast majority of auditors and their clients, and that this bias must be corrected. We do not agree with this assertion. The proposals regarding the extension of the scope of the audit should apply to the audit of all enterprises, regardless of size' (ACCA;3;6).

Given that ACCA members are far more strongly represented in industrial employment than as auditors, it is to be expected that its response will be concerned with the symbolic rewards that go with being a certified accountant in comparison with a chartered accountant. Unlike the ICAEW, the Association does not express confidence in the independence of auditors in the current framework. Rather than affirming its faith that they are independent, and can remain so even when undertaking non-audit work for a client (unlike the ICAEW), the ACCA 'recommend(s) that clear guidance be given as to how services may be provided to an audit client without undermining audit independence'. Noting that 'there is still widespread concern', it invites a 'debate on the whole issue' (ACCA;6;5). A second way to challenge the influence of the chartered bodies is for the ACCA to dilute the APB's importance and chartered bodies' influence by arguing that the APB be made subordinate to the ASB. Thus the ACCA firstly acknowledges that the statutory framework for financial reporting is outdated, and then adds that:

> 'Auditors should not, however, lead in this matter and have to anticipate user needs... the APB should develop its ideas in this respect in conjunction with ASB, given the latter's considerations of different user groups in its "Statement of Principles"' (ACCA;6;2).

More generally, since membership of ACCA is viewed by some as attracting less prestige than membership of the ICAEW and ICAS, we propose that certified accountants potentially have less to lose in any restructuring of audit regulation.

Whereas the ICAEW opposes the extension of the audit role for the benefit of wider interest groups, the ACCA is not so cautious. It envisages that 'the future purpose of the audit would not "merely" be the adding of credibility to financial and other information in accordance with the law, but also that of operating "as a check and balance on the proper conduct of enterprises in the public interest"' (ACCA;6;3). It then appeals to notions of professionalism to legitimise its preferences and to challenge the other bodies' entrenchment by saying that 'if we are to justify the title of "professionals" rather than that of "tradespeople" carrying out routine statutory assignments, we must develop our practice in line with the needs of the market for our services and in accordance with the interests of the business community and of the wider public' (ACCA;6;3).

5.4. The CIMA Submission

The three submissions considered so far all begin with a note that thanks or congratulates the APB for its document. The absence of such pleasantries in the CIMA submission is conspicuous and, presumably, intended. The CIMA response begins in a very direct and forthright way. It challenges a fundamental assumption of the *McFarlane Report*, and then sets out a contrary view:

> 'We do not believe that the role of external audit should be expanded, as indicated in the paper. The development of external audit would be aided by recognising that it: must remain a financial profession; must be divorced from the rest of the accountancy profession and independently regulated; and should not expand its involvement beyond reporting on financial performance, financial controls, and financial aspects of corporate governance' (CIMA;1;2–5).

Unlike the other three bodies, which are approved by the DTI as a source of registered auditors, CIMA members generally do not undertake the audit. Instead, the majority of its members work in industry or the public sector. In its response to *McFarlane*, CIMA opposes the expansion of the audit profession—a reform that also threatens to place the imprimatur on the chartered bodies' standard route to qualification as being (mainly) through public practice, thus excluding CIMA's members from this select group. Like the ACCA and CIPFA[25], the CIMA response puts emphasis on internal controls (CIMA;1;6;), a function that can be undertaken by those such as their own members who do not have public practice experience. CIMA also directly opposes central elements of *McFarlane* that are supported by the chartered accountants. Of greatest consequence, perhaps, CIMA advocates the abolition of the right of audit firms to undertake other work for their audit clients and confronts head on the justifications given for its continuation:

> 'We are sceptical of the "Chinese Walls" philosophy and would extend the ban on non-audit services to other entities under common ownership or control with the audit entity' (CIMA;3;7).
>
> 'Companies themselves should be required to certify annually that they have not employed any firm or company in any way connected with the audit firm which audits their financial statements to undertake non-audit consultancy assignments' (CIMA;3;8).

CIMA's proposed alternative to the existing regulatory arrangements is correspondingly bold. The setting up of 'a regulated regime independent of the professional accountancy bodies' is commended (CIMA;3;9). This proposal might strengthen the legitimacy of auditors, but the dilution of the other bodies' control of audit regulation could result in reduction in their status and hence their public regulatory role and prestige. Indeed, the proposal goes even further as it contends that:

> 'This regime could most effectively be achieved by divorcing the auditing profession from the rest of the accounting profession; restricting external auditing to reporting on financial performance, financial controls and financial aspects of corporate governance; and establishing a body to regulate the practice of external auditing which, for the purposes of this paper, we shall call an Audit Commission for public interest companies' (CIMA;4;1).

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[25] CIPFA criticises the report for not stressing 'the important role an effective internal audit function can play in helping to meet audit objectives' (CIPFA;1;6).

The effect of such a move would, arguably, be to shift auditing outside the etablished structure of accounting: accounting would thus be confirmed in its place as the centre of gravity of accountants' endeavours. Governed separately,[26] restricted in scope, staffed by auditors rather than accountants, there is a probability that the audit would fall in status, perhaps taking its practitioners and their institutes with it. CIMA also differentiates itself from the Association by proposing that the ACCA's preferred strategy of retaining a significant small company audit should not be supported: CIMA's suggested Audit Commission would deal with public interest companies only, and 'the compulsory small company audit requirement [would]...be rationalised and made optional' (CIMA;5;6). Finally, the CIMA submission proposes that its members, as accountants, should not contribute to the cost of the proposed Commission, but that the auditors should.[27]

Whereas the ACCA proposal insists only on the separateness of audit and accounting, the CIMA proposal takes this one stage further. It views the auditor as specialised, and hence an inappropriate person to be bracketed with the accountant. When considering the broadening of the audit task to 'review for any significant illegal act, financial or not', the CIMA response contends that:

> 'The auditor cannot and should not take on the role of policeman in areas outside of finance. He is not trained in other areas and in general will lack the required high degree of technical knowledge of them' (CIMA;8;1).

Perversely, then, there is some commonality between the submissions of the ICAS and the ICAEW, who are resistant to auditors being required to undertake extra responsibilities given the risks of litigation, and CIMA, which also objects to such extensions, but for the wholly different reason that auditors are not competent to undertake the work.

6. Discussion and conclusion

Prior to analysing the bodies' responses to the *McFarlane Report*, we argued that the meaning of the public interest is continuously negotiated rather than fixed; and that the relationship of UK accountancy bodies to the dominant institutions of the market and the state has enabled them to attain a position of considerable power and privilege, a position that has been bolstered and legitimised by the conferral of Royal Charters and confirmed by the sobriquet of 'profession' enjoyed by their members. As a consequence, and in contrast to responses by commercial enterprises which can be expected to be unequivocal in advocating courses of action that they anticipate will advance their (economic) interests, it might be expected that the obligation of accountancy bodies to serve the public interest, supported by their insistence that they are responsible professions and not mere trade associations, would lead them to formulate responses to *McFarlane* that are attentive to, informed by, and justified in terms of, their public interest responsibilities. Indeed, we may now refine this expectation.

The four reasons we adduced earlier to argue that the accountancy bodies would appeal to the 'public interest' are primarily concerned with auditing rather than accounting; and to the extent that they are concerned with, say, accounting standards, they relate to financial rather than management accounting. As a result, we might reasonably expect that stronger public interest arguments would be advanced by the three bodies approved (ICAEW, ACCA, ICAS) to undertake the audit than CIMA. However, the evidence of the bodies' submissions in response to the *McFarlane Report* provides little support for this expectation. This is most clearly the case of the small firm audit: the ICAEW wishes the *McFarlane* proposals to apply only to large companies and their (Big Six) auditors. In contrast, the ACCA, which has unsuccessfully campaigned to retain statutory audits for small companies, wishes the proposals to apply to all companies and auditors, thus enabling its members[28] (who tend to be sole practitioners or small firms) to secure new jurisdictions.

This cleavage in the advocacy of the competing bodies is potentially damaging to their claims to represent the public interest. Either the public interest would be served by abandoning the small company audit or it would not. If the bodies had sought to offer justifications for their respective responses, no doubt each could have offered a public interest justification for its position: the ICAEW in terms of saving the resources of the small business from expenditure on unnecessary audits, and the ACCA in terms of assuring small business and those associated with them of the trustworthiness of reported results, especially when audited by a professionally-qualified accountant. But, in the absence of any defence of such explicit claims in their submissions, the impression tacitly conveyed is one of special pleading rather than the expression of public interest concerns.

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[26] CIMA proposes that this governance be carefully divorced from practising auditors: 'As a matter of policy there should be a minority of professionally qualified accountants and auditors represented on [the Commission]' (CIMA;4;6). Similar suggestions are also made by Mitchell et al. (1991).

[27] CIPFA also supports an 'independent body with responsibility for the governance of the audit of all corporate bodies above a certain size' (CIPFA;4;15).

[28] In late 1996, ACCA members obtained the right to include the word 'chartered' in their title and are now known as chartered certified accountants. Whether this new designation will have any impact on the politics of securing additional jurisdictions for ACCA members remains to be seen.

In contrast to the ambiguity in the relationship of 'private' to 'public' interest arguments in the bodies approved to undertake audits, CIMA is straightforward in its advocacy. It uses terminology that conjoins its members' interests with those of the public. The main argument running through the CIMA submission is that auditors are of limited competence in a number of arenas, in contrast to accountants experienced in managerial processes; and that auditors' promises to maintain their independence by separating audit and non-audit services through the erection of substantive 'Chinese Walls' cannot be trusted, from which it follows that the privilege of selling non-audit services to audit clients should be removed. In each case, the private interest of CIMA's (relatively homogeneous) members is clear; but there is also a public interest argument, expressed in rational terms. To the extent that auditors are permitted or encouraged to expand the scope of their activities, those activities will be undertaken in a less efficient or effective manner than otherwise. It must be noted, however, that although we may detect this implicit public interest thread in CIMA's arguments, the expression 'public interest' does not appear explicitly, and must be teased out by readers mindful of the bodies' shared formal commitment and duty to serving 'the public interest'.

To interpret the comparative absence of explicit references to 'public interest' contained in all the bodies' responses to the *McFarlane Report*, it is relevant to consider the destination and anticipated audience for their submissions. Public interest arguments tend to be confined to occasions when leading representatives of the accountancy bodies seek to remind their memberships or the regulators of the basis of their association's power and privilege (see especially Worsley, 1985 and Willmott et al., 1993); or, more visibly, when the bodies seek concessions from government for auditing firms (for example, see ICAEW, 1996, on the issue of auditor liability), or when they provide reports, articles or soundbites for the media (for example, see Regulation Review Working Party, 1995, 1996) in response to those (e.g. journalists, politicians) who doubt the impartiality and 'professionalism' of their members' conduct and/or the bodies' capacity to discipline their members.

The responses to *McFarlane* do not fall into any of these categories. Even among their memberships, it is probable that only a small fraction of members, if any, read the submissions in full. The responses to *McFarlane* are more likely to be examined and evaluated by firms that act as the bodies' key sponsors. However, summaries of the submissions are disseminated to members (e.g. through their journals, district societies and committees). These seminars contribute to a process of constituting and refining members' understanding of their interests as well as inviting evaluations of the effectiveness of the bodies in representing what members deem to be their interests.

From this perspective, the contents of the bodies' responses to *McFarlane* and, more specifically, the limited expression of public interest concerns, can be comprehended in terms of the comparatively private nature of the communications between the bodies and the APB. Within this internal loop, there is little need to justify private interest claims in terms of public interest responsibilities and rhetoric.[29] Only the bodies that are not persuaded by the discourses of the dominant bodies may find a need to appeal to the 'public interest'. Only in CIMA's submission, where there is a direct challenge to the status quo, are public interest arguments mobilised in support of their criticisms and proposals.

Still, given that the submissions are also likely to be read by officials within the audit-authorised bodies' sponsoring ministry, the DTI, it is perhaps surprising to find such immoderate partisanship in the auditing bodies' responses. One interpretation would point to the political naiveté of the bodies. Alternatively, we surmise that *in the context of the preparation of responses to McFarlane*, the bodies would sense no obligation to use public interest rhetoric in support of their analyses and commentaries. This explanation points to the preoccupation of the bodies with their members and/or their self-confidence of feeling under little pressure, on such an occasion, to demonstrate their responsiveness to the public interest in matters that were not self-evidently likely to attract the attention of the media, politicians or academics.

To conclude, we have deliberately avoided adopting a decontextualised definition of 'public interest'. Instead, we have compared and contrasted the bodies' espoused concern to privilege the public interest with the contents of their responses to the *McFarlane Report*. While such espoused concern is frequently articulated in contexts where bodies seek to secure or justify privileges to a sceptical audience, in more private contexts their communications are unvarnished by the use of public interest arguments and rhetoric. Although jealously guarded and resolutely defended when doubted, their espoused commitment to the public interest lacks substantive confirmation in the rhetorics of their responses to the *McFarlane Report*, and thus casts doubt on the strength of their commitment to espoused public interest responsibilities.

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[29] Such a view carries greater force when it is recognised that the accountancy bodies who finance the operations of the APB are in a position to influence which projects are undertaken or ignored. In addition, there is evidence that the priorities of the APB (as was the *McFarlane* Report) are subject to private negotiations, with the accountancy bodies having privileged access to agenda and parameters of its discussions (Sikka, Willmott and Lowe, 1989; Sikka, 1992).

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Clean Surplus Accounting Models and Market-based Accounting Research: A Review

Martin Walker*

Abstract—This paper reviews recent attempts to provide a rigorous theoretical basis for market-based accounting research based on the pioneering ideas of Ohlson. We argue that the Ohlson development can best be understood as an attempt to restate economic theories of income measurement in the light of advances in the economics of asset pricing under uncertainty. We contrast the Ohlson approach with other economic theories of financial reporting, and conclude that, while the Ohlson approach has made a significant contribution to understanding the theoretical basis of market-based accounting research, it remains to be seen whether the method can be extended beyond the simple linear models that have so far been developed.

1. Introduction

This paper reviews recent attempts to provide a rigorous theoretical basis for market-based accounting research based on the pioneering ideas of Ohlson (1989b, 1990 and 1995) and Feltham and Ohlson (1993 and 1995). In a recent appreciation of this work, Bernard (1995) asserts that the studies 'stand among the most important developments in capital markets research in the last several years'.

This paper, while not seeking to reverse Bernard's positive assessment, will attempt to position recent developments in clean surplus accounting models in a broader context. It is hoped that this will enable the reader to better appreciate the limitations of the approach as well as its considerable strengths. Section 2 explains the relation of Ohlson's work to other attempts to provide a theoretical foundation for financial accounting based on neo-classical economics. We argue that the Ohlson development can best be understood as an attempt to restate economic theories of income measurement in the light of advances in the economics of asset pricing under uncertainty.

We also argue that the Ohlson development has important implications for market-based accounting research. As background for explaining these implications, Section 3 outlines a number of criticisms that have been levelled at market-based accounting research. This allows the reader to gain an appreciation of the specific limitations of market-based research that the Ohlson framework addresses. Sections 4 and 5 introduce the fundamental general features of clean surplus models and explain some of the potential advantages that may accrue from working within a clean surplus framework. Section 6 illustrates the central role of the information dynamics assumptions in constructing empirically-testable propositions from the general clean surplus framework. Section 7 identifies the advantages of the Ohlson approach that, at the time of writing, seem to be generally accepted. Section 8 discusses a more controversial claim for the approach. Section 9 outlines some potential limitations of the approach.

2. Economics-based approaches to financial reporting

Many of the earliest attempts to provide a theoretical framework for financial accounting based on economics were motivated by the idea that accounting income measures might be interpreted as objectively measurable proxies for the unobservable economic income concepts established by Fisher (1906) and, in particular, Hicks (1946).

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Whittington (1981) provides a useful review of the state of this literature in 1979.[1]

For present purposes, one of the most interesting points he makes is the observation that, following the influential contributions of Solomons (1961) and Edwards and Bell (1961), the literature divided into two reasonably distinguishable strands. One strand continued to pursue the notion of accounting income serving as a practicable proxy for economic income. The other strand abandoned the notion of income as a fundamental measure and concentrated on the construction of practicable techniques that satisfied users' perceived needs, irrespective of their properties as fundamental measures of economic income. The first strand, which we refer to as the fundamental measurement approach to accounting, had, so far as the leading academic accounting journals are concerned, run into the sands at the time of Whittington's review. The work of Solomons (1961) heralded this decline, and the subsequent influential contributions of Barton (1974) and Beaver and Demski (1979) seriously questioned the logical validity of attempts to explain accounting income as a fundamental measure.

For present purposes this is an important point, because the work of Ohlson and his co-authors represents an attempt to move accounting theory back in the direction of the fundamental measurement perspective. We will therefore need to consider below whether this attempt offers anything new as a counter to the criticisms that caused the fundamental income measurement approach to lose its influence over academic accounting around 20 years ago.

A second, economics-based, approach to financial reporting began to emerge in the late 1960s following the publication of Ball and Brown (1968). This paper is generally acknowledged as the seminal work that spawned a whole generation of empirical research concerned with modelling the effects of financial reporting on capital markets in general and stock markets in particular. This research is generically referred to as market-based accounting research (MBAR for short).

A number of scholars have reflected on the reasons for the emergence of MBAR. Some of the key influences were:–

1. The emergence of positive economics in the US as the dominant research paradigm, and the need felt by American accounting scholars to gain academic respectability for their work. In particular, the influence of positivist ideas led to a questioning of the scientific integrity of income measurement theorists who sought to justify their preferred positions axiomatically with little or no consideration of the empirical testability of their ideas.
2. The early success of research by financial economists on the informational efficiency of capital markets, enlivened by access to novel computer-based share price databases and econometric packages.
3. A growing recognition within accounting of the need for a more sophisticated understanding of the needs of users of accounting information.

In fact these three influences gave rise to two new economics-based approaches to financial reporting. On the one hand there was MBAR, which was positive in approach and which sought to test empirical propositions about accounting using real world share price and accounting data. On the other, there emerged a body of abstract theoretical research based on advanced mathematical economics. I refer to this second body of work as the information economics approach (see Walker, 1988).

During the first decade or so of the new economics of accounting, the fact that some scholars were producing empirical results from a weak theoretical base, while others were busy generating abstract theories remote from empirical testing, seemed reasonable for a newly developing line of inquiry. The hope was that, in the course of time, the two approaches would converge as MBAR became theoretically more sophisticated, and as the mathematical models reached a stage where mathematical propositions could be cast into empirically-testable form. Unfortunately, this convergence of the two approaches has not occurred. Moreover, the failure to converge is but symptomatic of a rift within economics between econometrics and mathematical economics (see Kreps, 1990:7).

I have reviewed elsewhere some of the problems involved in applying information economics to accounting (see Walker 1988, 1989). There are major questions about the empirical testability of such ideas (Walker, 1989), but for the present purposes the most serious problem with the information economics approach is the lack of a defensible mapping from the way information economists represent information (in terms of partitions defined over exogenously specified states of the world) and basic accounting concepts such as the balance sheet and the income statement (Walker, 1988). In particular, neo-classical economics has failed to develop a theory of income measurement in which there is an endogenous demand for some form of income measurement (see Beaver and Demski, 1979).

In the late 1970s, a third body of work emerged that sought to combine the empirical methods of positive economics with the insights of the property rights view of agency theory. This work, which I refer to as positive accounting theory (PAT for short), complemented developments in market-based accounting research by focusing on supply side influences on the market for corporate financial information.[2] This literature provides theoretical explanations, based on the costs of writing and enforcing contracts, of why heterogeneous accounting methods might arise naturally in economic equilibrium. It also provides evidence that the accounting choices made by corporate managers are broadly consistent with the costly contracting framework. Watts and Zimmerman (1986, 1990) review this work.

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[1] For an overview of economic theories of financial reporting see Bromwich (1992).

To summarise, during the late 1960s and throughout the 1970s many accounting academics, especially in the US, advocated neo-classical economics as a theoretical foundation for accounting. Three major bodies of work later became established, MBAR, information economics, and positive accounting theory. A common feature of these new approaches was a rejection of income measurement perspectives on financial reporting. In the following sections we argue that the Ohlson framework is best understood as an attempt to combine traditional notions of income measurement with advances in the economic theory of capital asset pricing. In assessing the potential fruitfulness of the Ohlson approach one needs to consider, in addition to the improved model specifications it may yield for market-based research, the extent to which the approach limits the potential for introducing the insights of information economics and PAT into a general model of financial accounting.

3. Limitations of market-based accounting research

Market-based accounting research has been the subject of attack on a number of levels.[3]

1. *Questioning the methodological foundations of MBAR*

It has been argued that the methodologies of the natural sciences are not appropriate to a subject like accounting (see, for example, Tinker et al., 1982; Whitley, 1988).

2. *Questioning the theoretical foundations of MBAR*

A number of philosophers and social scientists outside economics question the possibility of getting useful insights on a complex subject like accounting from a theoretical approach that is based on highly unrealistic assumptions about human behaviour. In particular, many scholars have questioned the applicability of the strong rationality postulates of neo-classical economics in the context of accounting. The fundamental issue raised by this line of criticism is, if accounting is supposed to help people cope with complexity, then why base a theory of accounting on an assumption that people are perfectly rational?

3. *Questioning econometric-based approaches to empirical research*

Within the discipline of economics, opinion is divided on the usefulness of econometric studies as a basis for testing economic theory. This is especially so in the area of game theory and information economics, where many theorists in the field would seriously question the possibility of using econometrics to test their ideas. Laboratory studies and case studies tend to be viewed more favourably by such theorists (see Kreps, 1990, chapter 15).

4. *Questioning the empirical performance of MBAR*

The first two criticisms are criticisms from outside the discipline of market-based research. The critics do not like the rules of the game, and some believe it is a silly game to play. More recently, a number of skilled market-based researchers have questioned the success of MBAR even within the rules of the MBAR game. A paper by Lev (1989) was particularly devastating in this regard in pointing out that the goodness of fit achieved by attempts to model the relation between unexpected earnings and stock returns was consistently very poor by the usual standards of the econometrics. The Lev critique was influential in forcing market-based researchers to concentrate their efforts on discovering the reasons behind the poor performance of MBAR models. Possible reasons include:

i) Poor specification of the empirical model and/or poor research design, i.e. the researchers are in error.

ii) Firms may be faithfully applying GAAP, but the resultant earnings are anticipated by the market with access to superior information, i.e. the results follow from the nature of GAAP.

iii) Reported earnings may be unreliable indicators of firm performance because of widespread and deliberate misapplication of GAAP, i.e. the preparers and auditors are in error.

iv) Firms may be faithfully applying GAAP, but the market fails to respond rationally to the information, i.e. the stock market is informationally inefficient.

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[2] This paper is not the first to stress the distinctions between MBAR and PAT. Mattessich (1995, chapter 9) also makes this distinction and provides further explanation of its importance in understanding the development of accounting thought.

[3] Mattessich (1995) presents a useful summary of the philosophical criticisms of MBAR.

Note that these four explanations are not mutually exclusive; all four explanations could be partially correct.

5. Questioning the policy relevance of MBAR

One way of assessing the value of a body of research is to consider the usefulness of the findings of such research for policy makers. MBAR has been attacked in a number of quarters for its apparent failure to deliver policy-relevant results, though some of these criticisms may reflect more on the ignorance of policy makers about what empirical research can achieve rather than any failure of MBAR. In assessing its usefulness, the following points should be considered:

i) MBAR seeks to provide positive empirical evidence about how the world works. It cannot deliver direct policy advice because you can never derive a normative proposition from positive observation alone. Someone needs to specify what the objectives are; then MBAR may be able to help in advising how to achieve those objectives.

ii) MBAR has provided evidence that the stock market is quite sophisticated in its response to accounting information. The idea that the entire market responds to accounting numbers naïvely has been firmly rejected. However, there is still disagreement about the degree to which the market is fooled by creative accounting.

iii) MBAR has provided overwhelming evidence that the market responds to earnings information in a manner broadly consistent with the view that such information is useful for predicting future cash flows, i.e. earnings have predictive value. If policy makers care about the uses to which accounting is put, then the predictive value of earnings is one of the factors they should consider.

iv) MBAR is severely limited in its domain of application. It focuses exclusively on the predictive value of accounting information for investors in quoted companies. MBAR has little to say about other (e.g. stewardship) uses of accounting, and largely ignores the needs of other users apart from investors. Its relevance for unquoted firms is severely limited, though some have tried to apply valuation models based on small quoted companies to value small unquoted companies.

v) Public policy makers are not the only potential end users of MBAR. Companies like to know what factors drive their share price, and investment analysts and private investors are also interested in how the market responds to accounting information in general, and earnings in particular. Witness, for example, the recent explosion of interest in shareholder value analysis.

vi) It is difficult to address issues of traditional concern to accounting policy makers within the standard market-based empirical framework. Issues such as current cost accounting versus historical cost accounting, accounting for goodwill, and accounting for R&D, are traditionally discussed within an income measurement framework. The theoretical starting point of MBAR was a rejection of the ideas of income measurement theorists in favour of an information perspective that seeks to treat earnings as simply one signal among a large number of other possible signals about future cash flows.

In understanding the contribution of Ohlson's work it is helpful to consider which of the above five forms of criticism is addressed by his theoretical framework. We argue below that the Ohlson framework can be viewed as an attempt to improve market-based accounting research by combining modern economic theories of rational capital markets with economic theories of income measurement. Thus the new framework does not address any of the first three forms of criticism. Hence the importance of the contribution needs to be judged by its potential to improve the empirical performance of MBAR models, and by its potential to increase the policy relevance of capital markets-based accounting research.

4. MBAR with measurement: motivating the Ohlson approach

4.1. Back to Basics

In many fields of scientific endeavour it is sometimes necessary to take two steps backwards before further progress is possible. The essential message of Ohlson's recent work is the need to return MBAR to basics. Ohlson argues that the abandonment of income measurement theory in the late 1960s was a fundamental error in the development of accounting research in general and in MBAR in particular. He advocates a new approach to market-based research that seeks to combine a measurement perspective with notions of arbitrage-free and informationally-efficient markets. This approach involves the following basic steps in theory construction:

1. Specify an accounting technology that translates economic events into accounting numbers.
2. Assuming informationally-efficient markets, specify a valuation model that translates economic events into stock market valuations.
3. From 1 and 2, derive the implied relation between accounting numbers and stock market valuation.

Empirical work within this framework focuses on deriving and testing aspects of the implied relation 3. For illustrative purposes, let us suppose that relation 3 can be expressed as follows:

$$p_{it} = F(x_{it}, u_{it}; \theta_{it}).$$

Where p is the stock market price per share, $F(.,.;.)$ is a function of a vector of observable accounting numbers, x, a vector of unobservable variables, u, and a vector of parameters, θ. The subscripts i and t stand for firm i and time period t. The purpose of the theoretical analysis is to produce a restricted form of $F(.,.;.)$ which offers some prospect of being empirically testable, i.e. which gives rise to at least one empirically-testable proposition. Examples of the kinds of proposition that might emerge from applications of this approach would be:

i) Identification of key accounting numbers likely to be most closely associated with market prices, e.g. 'market price depends principally on current earnings per share and book value per share'.

ii) Propositions about the functional form of F, e.g. 'F is linear in earnings and book value'.

iii) Propositions about how the estimated values of the model parameters might vary over time.

iv) Propositions about how the estimated values of the model parameters might be expected to vary across different types of firm.

Notice that all such propositions are joint hypotheses, in the sense that they depend for their validity on both step 1 and step 2 of the analysis. In particular, since step 2 relies on the assumption of informationally-efficient markets, it follows that any negative empirical evidence could be due either to some flaw in the representation of the accounting technology, or due to some type of informational inefficiency.

4.1.1. Early Examples

In a somewhat neglected paper, Easton (1985) examined the explanatory value of current earnings and current dividends for a proxy for the present value of future dividends. He found a significant positive association between current earnings and future dividends, and (controlling for current earnings) a negative association between current dividends and the present value of future dividends. Anticipating the subsequent work of Ohlson, he wrote:

> 'These results are consistent with the notion that accounting earnings reflect the dividend-paying ability of the firm and that these earnings may be either paid in the current period or reinvested' (p.75).

An early example of the 'MBAR with measurement' approach was the paper by Board and Walker (1990) which, in working paper form, predated Ohlson's work. Board and Walker used the empirical methods of MBAR to test one of the basic insights of income measurement theory, i.e. that historical cost accounting is likely to be less informative in economies where the rate of inflation is high and uncertain. If this insight is correct, and if the market knows this, then one expects to see the market placing less reliance on historical cost earnings during periods of high inflation. Board and Walker tested this idea and found statistically significant results in support of their theory.

Another paper that anticipated the Ohlson approach was the paper by Kormendi and Lipe (1987). They noticed quite marked cross-firm differences in the time-series properties of reported earnings. Some firms had earnings numbers that evolved in a random walk-like manner, but other firms had earnings numbers that seemed highly transitory. Kormendi and Lipe predicted that the relation between stock market returns and a measure of unexpected earnings would be more pronounced for firms with random walk-like earnings than it would be for other firms. This prediction was strongly supported by their empirical evidence.

5. Clean surplus accounting and company valuation

Models within the general Feltham/Ohlson tradition have come to be recognised by two key features, i.e. the clean surplus accounting model, and linear information dynamics. Of these two features, the clean surplus valuation model is the most fundamental. When implementing the clean surplus valuation model it is necessary to make specific assumptions about how information evolves over time, but such assumptions can be made in a variety of ways. Moreover, while the assumption of linear information dynamics will typically make the clean surplus model easier to solve, we will see that there are a number of reasons to expect real world information dynamics to be non-linear.

The purpose of this section is to introduce the general clean surplus valuation model without making any specific assumptions about the information dynamics. The following section introduces three special cases of the general model, which all assume some form of linear information dynamics. The final section of this review outlines some of the reasons why the assumption of linear information dynamics may prove to be too restrictive.

The clean surplus valuation model is based on two main assumptions, described in the following two sub-sections.

5.1. Clean Surplus Accounting

The following accounting identity is assumed to hold:

$$y_t \equiv y_{t-1} + x_t - d_t \tag{1}$$

where y_t = book value at the end of period t;
x_t = earnings in period t;
d_t = dividends (net of capital contributions) paid at the end of period t with the initial condition $y_0 = -d_0$.

5.2. Present Value Valuation

$$p_t = \sum_{\tau=1}^{\infty} R_F^{-\tau} E_t\,(d_{t+\tau}) \qquad (2)$$

where $R_F \equiv$ one plus the risk-free rate of interest.

In words, this equation states that the firm's ex-div market value at time *t* is equal to the present value of expected future dividends. Following Ohlson, we assume a risk-neutral economy and discount future dividends using the risk-free rate.[4]

From (1) and (2) one can derive the following basic implication:

$$p_t = y_t + \sum_{\tau=1}^{\infty} R_F^{-\tau} E_t[x_{t+\tau} - (R_F - 1)\, y_{t+\tau-1}] \qquad (3)$$

The only assumptions required for (3) are clean surplus accounting and the dividend valuation model. Equation (3) states that the value of the firm will be equal to the book value of the firm plus the sum of the discounted abnormal earnings that the firm is expected to generate over its lifetime. Abnormal earnings are defined as the difference between earnings and opening book value, times the required rate of return. In management accounting, abnormal earnings is referred to as residual income.[5]

Bernard (1995) argues that one of the principal advantages of the clean surplus model stems from its performance in finite horizon approximations. Note that both equations (2) and (3) require forecasts out to infinity. How well do the models perform when they are truncated at some finite point? Bernard shows that (3) works much better when fitted to value line forecasts than (2). Specifically (3) explains 68% of cross-sectional variation in share price compared with 29% for model (2). This improvement in the statistical fit of (3) over (2) arises essentially because truncation of the dividend stream in (2) leaves out a large part of the value stream, since no estimate of the capital stock is incorporated to pick up the missing future dividends. In contrast, the truncated residual income series contains an embedded closing capital stock.[6]

The problem with Bernard's argument is that it does not provide any explanation as to why the US accounting technology and economic environment leads to this result. Equation (3) holds for any set of earnings numbers that cause (3) to converge. In particular, equation (2) is a special case of (3), with book value defined to be equal to zero for all *t*. Thus there must be something special about reported earnings and book values to cause such impressive improvements in explanatory performance.

The key to understanding why accounting book values might yield superior explanatory performance turns on the fact that reported book values reflect the rational investment choices of firms, and assessments by the firm (and its accountants) of capital expenditures that can be booked as assets. A fundamental feature of accruals-based accounting is that it classifies expenditures into revenue and capital. To the extent that the discounted present value of the expected future net cash flows generated by current capital expenditures are greater than or equal to the amount currently booked as 'capital expenditure', a truncated equation (3) based on earnings and book values will tend to produce a better statistical fit than the truncated dividend series. Note, though, that this superiority arises because the currently booked capital expenditures have positive net present value.

In other words, accounting numbers provide a better association with market values because, somehow, managers have been motivated to adopt investments with value. This point is important in evaluating the usefulness of the Ohlson framework relative to other frameworks that attempt to demonstrate an endogenous rationale for accruals-based financial reporting.

The Ohlson framework, in its current form, relies on an implicit assumption that managers' investment decisions are properly motivated. Other frameworks would question the legitimacy of assuming that managerial behaviour is determined independently of how the firm is accounted for. For example, advocates of an agency view of accounting would seek to model earnings as a measure of performance designed to *induce* appropriate managerial behaviour.

6. Clean surplus models with linear information dynamics

We have seen that (3) holds for any sequence of numbers that satisfy the clean surplus relation and for which the discounted sum of expected abnormal earnings converges. To convert (3) into testable hypotheses about the relation between share prices and accounting values, we need to introduce more structure into the model that specifies a link between observable variables and expected abnormal earnings. We also need to find some reasonable way of truncating the infinite sum at some finite time horizon.

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[4] For applied purposes the normal practice is to replace the risk-free rate with the required rate of return on equity.

[5] Preinrich (1938) is generally credited with the first formal exposition of the model. The idea was further developed in Edwards and Bell (1961) and Peasnell (1982).

[6] I am grateful to Ken Peasnell for clarifying this point. For further elucidation the reader should consult Peasnell (1982), especially p.364 (equation 5).

We refer to this additional structure as the information dynamics of the model. We illustrate the notion of information dynamics with three examples.

6.1. *Example 1: A Random Walk Model for Earnings*

Assume:

1. Earnings follow a random walk;
2. All earnings are distributed;
3. The market observes no information, other than accounting earnings, book value and net dividends.

This simple model underlies much of the MBAR literature (see Ball and Brown, 1968; Kothari, 1992; Kothari and Sloan, 1992; and Kothari and Zimmerman, 1993). If these assumptions hold, equation (3) implies the following valuation relation:

$$p_t = \frac{1}{(R_F - 1)} x_t . \tag{4}$$

Given the assumptions of the random walk model, ex-div price is one over the cost of capital times earnings.

Implicit in this model are two other assumptions that do not generally hold. First, because dividends are restricted to equal earnings, the possibility of dividends providing information over and above earnings and book values is ruled out a priori. In other words, dividend signalling is impossible in this context. Second, since the random walk assumption implies that future earnings changes are unpredictable, the model implicitly rules out conservative accounting.

6.2. *Example 2: Ohlson's Unbiased Accounting Model*

The model developed in Ohlson (1995) assumes that abnormal earnings evolve as a simple autoregressive process:

$$\tilde{x}^a_{t+1} = \omega\, \tilde{x}^a_t + \tilde{v}_t + \tilde{\varepsilon}_{1t+1} \tag{5}$$

$$\tilde{v}_{t+1} = \gamma\, \tilde{v}_t + \tilde{\varepsilon}_{2t-1} \tag{6}$$

In this model, v_t represents information that is observed at the end of period t, and which is useful for predicting abnormal earnings for years $t+1$ onwards. The model also assumes that v_t is unrelated to current earnings and dividends. The two disturbance terms in (5) and (6) are assumed to be mean zero and serially uncorrelated, though they may be contemporaneously cross-related.

The random walk model of earnings is a special case of this model in which ω equals one, all earnings are distributed, and where γ and the variance of ε_{2t} both equal zero.

This model introduces two new ideas. The first is the notion of information that is observed by the market before it affects reported earnings. This is captured by the term v_t that is observed in period t but does not affect earnings until $t+1$. The second is the notion that abnormal earnings may converge to zero over time. Specifically, if one assumes that both ω and γ are less than one, abnormal earnings will converge to zero, which in turn implies that book values and market values will converge.

Ohlson (1995) shows that his model implies the following exact valuation relation:–

$$\tilde{p}_t = k(\varphi\, \tilde{x}_t - \tilde{d}_t) + (1-k)\, \tilde{y}_t + a_2 \tilde{v}_t \tag{7}$$

where

r is the risk-free rate of interest

$k = r\,\omega/(1 + r - \omega)$

and

$\varphi = (1 + r)/r$

The value of the firm in general can be represented as a weighted sum of two accounting-based valuations plus the additional value implied by the information that is known about future earnings but is not yet reflected in earnings or book values. The first accounting valuation, which is weighted by k, is just a multiple of current earnings less the current dividend. The second accounting valuation, which is weighted by one minus k, is simply the book value of the firm. In the extreme case where k equals 1 (and $\omega = 1$) the formula places all the weight on the earnings-based valuation of the firm. In the opposite extreme case where k equals zero (and $\omega = 0$), all the weight is placed on the book valuation of the firm.

Equation (7) can also be equivalently expressed in terms of the abnormal earnings construct. We get:

$$p_t = \alpha_1 x^a_t + y_t + \alpha_2 v_t \tag{8}$$

where

$\alpha_1 = \omega/(R_F - \omega)$,

and

$\alpha_2 = R_F/(R_F - \omega)(R_F - \gamma)$

In addition to deriving the closed form valuation formula, (7) (or equivalently (8)), Ohlson showed that his model implies the following important relationships between dividends and future earnings, and dividends and company value[7]:

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[7] These additional properties require two further assumptions in addition to those of the basic clean surplus model. These are: $\partial y_t/\partial d_t = -1$, and $\partial x_t/\partial d_t = 0$. In words these say that, ceteris paribus, one additional pound of current dividends reduces reported end of period book value by one pound, and one additional pound of current dividends has no effect on current reported earnings.

1. The payment of an additional pound of dividends at time point t reduces the expected earnings of period t+1 by $(R_F - 1)$ pounds.
2. The payment of an additional pound of dividends at time point t reduces the aggregate expected earnings for periods t+1 and t+2 (including any earnings generated by reinvesting any dividends expected at time point t+1) by $(R_F^2 - 1)$ pounds.
3. Consistent with Miller and Modigliani (1961), the model satisfies dividend payment irrelevancy, i.e. the payment of one additional pound of dividend reduces the market value of equity by one pound.

6.3. Example 3: Cash Flow Information Dynamics and Conservative Accounting

In the early development of his clean surplus valuation framework, Ohlson was strongly resistant to the idea of working with cash flows as a valuation attribute (see Ohlson, 1990).

However, rejection of cash flows as a valuation attribute does not rule out the possibility of representing the information dynamics of the firm in cash flow terms. Feltham and Ohlson (1993) work with the following cash flow information dynamics:

$$cr_{t+1} = \gamma\ cr_t + \kappa\ ci_t + v_{1t} + \varepsilon_{1t+1} \tag{9a}$$

$$ci_{t+1} = \omega\ ci_t + v_{2t} + \varepsilon_{2t+1}\,, \tag{9b}$$

where *ci* represents capital expenditure and *cr* represents operating cash flows. The ε_1 and ε_2 terms represent current period shocks, and the v terms represent shocks that are observed by the market before the current period. The model contains three key parameters: γ represents the degree of persistence in operating cash flows; ω represents the tendency for capital expenditure to grow over time; and κ represents the effect of capital expenditure on cash flows, i.e. a profitability parameter. In this model, the present value of the expected cash flows generated by one pound of investment will be $\kappa/(R_F - \gamma)$, i.e. the present value of the declining perpetuity $\kappa\gamma^{t-1}$ (t = 1,....).

Two new valuation effects arise in this model that are not considered in Example 2. The first is the effect of the firm's depreciation policy on the book value of past capital expenditures. In particular, the model allows for the possibility of conservative accounting. The second is the possibility that profitable capital expenditures may be anticipated by the market before they are formally recorded in the accounts. These new logical possibilities feed through into the valuation model that Feltham and Ohlson derive for this specification of the information dynamics:

$$\begin{aligned} V_t = {} & k[\varphi\ ox_t - c_t] + (1-k)\ oa_t \\ & + \alpha_2 oa_{t-1} + \alpha_3 ci_t + z_t \end{aligned} \tag{10}$$

where *ox* represents operating income, *c* is net cash flow, *oa* is book value of operating assets, and *z* is a collection of terms involving v_1, v_2, and ε_1. This equation is similar to equation (7) except we now have two new terms that affect company valuation, i.e. a term involving lagged book value and a term involving current capital expenditure. The first of these terms arises only if the rate of accounting depreciation differs from the rate at which operating cash flows decline. This term will be strictly positive if and only if accounting is conservative, i.e. if the accounting rate of depreciation exceeds the rate at which operating cash flows decline. The second new term reflects the net present value of recently implemented projects plus the present value of any future positive NPV investment opportunities anticipated by the market.

6.4. Section Summary

By working with models with linear information dynamics we are able to produce accounting-based valuation models based on observable data. These models are substantially more general than a simple random walk in earnings, and allow one to produce a logically consistent representation of several fundamental characteristics of financial reporting systems, such as:

i) the importance of the persistence of abnormal earnings in determining the relative weighting of earnings and book value in accounting-based valuation models (see equation (7));

ii) the effect on market valuation of events observed by the market before they are reflected in the published accounts;

iii) the possibility that the market may impound the NPV of new projects into price either during or before the year the actual capital expenditure is reported in the accounts;[8]

iv) given clean surplus accounting, the effect of conservatism on accounting-based valuation models is captured by a term that represents the undervaluation of opening net assets.

7. Advantages of the Ohlson approach

In my view, the principal advantages of the Ohlson approach are:

i) The approach has served to refocus attention on fundamental valuation issues, and has revived interest in models that attempt to explain firm valuation directly rather than correlating earnings surprises with returns. Penman (1992) provides a powerful argument for a change of emphasis away from excessive attention on returns/earnings models to fundamental valuation models. In particular, Penman's attempt to derive fundamental measures of value, independent of current market price, has opened up the possibility of a new approach to assessing the informational efficiency of stock markets which we discuss in Section 8. However, while one may accept that a change of emphasis from returns models to price models is desirable, one must also be careful to ensure that the swing against returns-based approaches is not allowed to go too far.

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[8] Clubb (1996) considers the implications of this model for the effects of capital expenditure news on stock returns.

In general, the choice of research design should depend on the issue at hand. There are bound to be some issues where a returns-based approach will be indispensible, e.g. understanding the motivation for certain types of voluntary disclosures. Moreover, there are other issues where return/earnings models and valuation models produce complementary information (see, for example, Kothari and Zimmerman, 1993). In thinking about such research design issues, I find it helpful to think in terms of long-run versus short-run effects.

Valuation models provide indications of the long-run valuation relations. Returns studies help one to explain short-run deviations from the long-run relation. Time series econometricians have devised a general methodology (cointegration analysis) which combines short-run dynamics relative to a long-run equilibrium into an error-correction model. MBAR studies that combine levels and returns regressions are primitive forms of cointegration analysis. The essential message of the cointegration literature is that short-run and long-run effects need to be modelled jointly.[9]

ii) The approach forces the researcher to account explicitly for the impact of retained earnings on future earnings. If a firm retains a large proportion of its earnings, then future earnings will be expected to be higher by virtue of the extra income generated by accumulated retention. The full implications of this point for empirical researchers are explained in Easton, Harris and Ohlson (1992). More generally, the clean surplus model clearly articulates logically distinct roles for earnings and dividends, and also explains why, and how, book values might sensibly enter into an accounting-based valuation model. Specifically, the approach shows why price, in general, does not equal the present value of expected earnings. This fundamental insight is important if MBAR is ever to be used to address income measurement issues. Three papers that illustrate the value of the Ohlson insight here are Ohlson (1989a), Ohlson and Penman (1992) and Green et al. (1995).

Ohlson (1989a) reconsidered the ungarbled earnings construct of Beaver, Lambert and Morse (1980) (BLM). He showed that the assumptions of the BLM model impose an implicit restriction on the relation between their ungarbled earnings and dividends. Specifically, the model forces expected dividends to be a constant proportion of expected ungarbled earnings. Ohlson concludes that the BLM ungarbled earnings construct '...is limited because of the absence of a useful distinction between ungarbled earnings and dividends'.

Ohlson and Penman (1992) identified specific line items (e.g. depreciation) that are likely to be problematic in accounting terms, and hypothesised that the strength of the relation between returns and earnings will be negatively related to the importance of these items as a fraction of earnings. The paper's empirical results were strongly supportive of the hypothesis. These results suggest that at least part of the Lev critique is explained by poor earnings numbers rather than poor research.

Green et al. (1995) use the Ohlson framework to explain how R&D should influence the value of the firm in an efficient market. The authors show that the market places a substantial value on R&D (about three to five times current R&D expenditure).

iii) The clean surplus approach has helped to provide a more coherent theoretical framework for traditional market-based studies. Ohlson (1991) and Ohlson and Shroff (1992) explained why the deflated earnings variable could yield improved statistical performance over the deflated first difference of earnings.

Ohlson's basic insight was substantiated by empirical research (see Easton and Harris, 1991 and Strong and Walker, 1993). Moreover, by combining the basic insight of Ohlson with panel data econometric methods, one can produce returns/earnings models with much better statistical performance (see Strong and Walker, 1993).

Following Ohlson (1991), a number of papers have been concerned with improving our understanding of the way in which reported earnings evolve over time, the ability of the market to observe the various contributors to this evolution, and the implications of this improved understanding for the empirical specification of price-earnings relations.[10]

A particularly interesting example of such work is Ramakrishnan and Thomas (1991). This paper introduces a simple structural model of reported earnings. The model represents reported earnings as a noisy form of price-relevant earnings. The evolution of price-relevant earnings is assumed to be driven by a predictable component (due to the effect of retained earnings), and a mixture of permanent and transitory random shocks. The authors also consider the following earnings-based prediction of end of year share price and dividend:

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[9] Charemza and Deadman (1992) contains a user-friendly introduction to cointegration.

[10] Subsequent theoretical work by Kothari (1992) and empirical work by Kothari and Sloan (1992) and Donnelly and Walker (1995) has shown how the deflated earnings yield variable can yield superior statistical performance in a context where the market has access to information that allows it to generate predictions of future earnings better than predictions based on the past time-series of earnings alone.

$$E(p_t + d_t) = (1 - k)[R/(R - 1)X_t] + k[p_{t-1} + X_t] \quad (11)$$

Here, the researcher's objective is to forecast end of period price plus dividend, given only price at the start of the year and earnings for the year. A pure earnings-based forecast would be given by $(R/R - 1))$ times earnings for the year. A price-based forecast would be last year's price plus this year's earnings. The authors assume that the best forecast available to the researcher will be some weighted combination of these two alternative forecasts, and use k to represent the weight placed on the price-based forecast. The authors go on to show that, holding the first-order serial correlation of excess reported earnings[11] constant, the optimum value of k will vary across firms in ways that can be predicted from the following parameters:

a) The ratio of the variance of the forecast errors from model (11) to the variance of excess reported earnings;

(b) The second-order serial correlation of excess reported earnings.

The first of these parameters reflects the ability of the market to distinguish between permanent and transitory shocks to price-relevant earnings. The second parameter reflects the market's ability to extract any price-relevant noise from reported earnings. The authors report statistical evidence, based on estimated values of the relevant parameters for around 600 companies, which suggests that a significant proportion of the cross-sectional variation in k is explained by non-earnings information and price-irrelevant shocks.

In relation to the Lev critique of MBAR, this new work has shown that part of the explanation for the poor performance of the early returns/earnings models was due to poor empirical specifications that failed to represent adequately either the different types of shocks which drive reported earnings or the market's ability to observe value-relevant information that is not available to the researcher.

iv) The revival of interest in the clean surplus approach has led to a renewed focus on profitability analysis as a framework for the fundamental valuation of equities. For the 20 years following Ball and Brown, market-based accounting research paid little heed to a fundamental feature of economic life, i.e. the market forces tend to drive abnormal economic profits to zero. The clean surplus approach indicates that the firm's market value will equal its book value plus the discounted present value of expected abnormal profits. Further analysis of this model has served to highlight the fact there are only two basic reasons why predictable abnormal profits can occur: (a) predictable 'errors' due to conservative (or aggressive) accounting practices; or (b) predictable future abnormal economic profits arising from current or future investments. If competitive forces are strong then, for most firms, it will be reasonable to assume that abnormal economic profits will be close to zero beyond some finite time horizon. Under these circumstances the equity valuation task can be structured as follows:

- Determine whether the firm's accounting practices have been conservative or aggressive and, where necessary, adjust the reported book value per share accordingly;[12]
- Consider the firm's market circumstances with a view to choosing a finite horizon for which it is reasonable to assume that abnormal profits beyond the horizon will be negligible;
- Forecast abnormal profits per share up to the time horizon;[13]
- Input the information from the previous three steps into equation (3), to provide the estimated current value per share.

Three papers that elucidate the strengths and potential weaknesses of this approach to valuation are Bernard (1993), O'Hanlon (1996) and Ou and Penman (1993). For present purposes, the paper by O'Hanlon is especially interesting because it highlights a conceptual difficulty implicit in the model of Feltham and Ohlson (1993). O'Hanlon points out that the Feltham and Ohlson model permits the existence of a persistently growing stream of positive NPV projects. This is problematic because economic intuition suggests that competition should eliminate the availability of positive NPV opportunities within a finite time horizon. O'Hanlon attempts to circumvent this difficulty by assuming that part of the payoff on investment projects accrues in the form of new positive NPV investment opportunities. His analysis shows that the Feltham and Ohlson model needs to be set within the context of capital budgeting procedures that ignore sunk costs, and accounting depreciation procedures which typically over-depreciate expenditure on growth options.

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[11] Excess earnings is defined as the first difference of abnormal earnings.

[12] Here, the book value should also be adjusted for the cumulative effect of any previous deviations from clean surplus accounting practices, e.g. due to the (current UK) practice of writing off acquired goodwill against reserves.

[13] Here, the object of the forecast should be the abnormal profits the firm is expected to report under unbiased clean surplus accounting practices.

8. Using the Ohlson framework to test information efficiency

Event study methods are traditionally used in MBAR to address the quality of the stock market's response to new information. MBAR has shown that share prices respond quite strongly to earnings announcements. However, there is some evidence, notably the post-earnings-announcement-drift (PAD) literature, which suggests the market takes time to fully adjust to the new information. PAD is a market pricing anomaly that has been identified by traditional MBAR methods (see, for example, Bernard and Thomas, 1989). However, there are some researchers who believe that the market makes systematic valuation errors that may take several years to correct. Traditional event study methods may not be powerful enough to detect such mispricing. One potential advantage of the Ohlson approach may be to provide a theoretical framework for modelling medium to long-term mispricing. This potential advantage has not, so far as I am aware, been claimed by Ohlson himself. It has, however, been claimed by Penman (1992), Bernard (1993) and Brennan (1995).

This work is especially interesting because it offers the prospect of providing an explanation for a well-documented capital market anomaly that has come to be known as the market-to-book effect. A number of highly respected researchers have found that the cross-section of expected returns tend to be negatively correlated with the ratio of stock price to book value per share (see, for example, Fama and French, 1992). Moreover, market-to-book contributes additional explanatory value for the cross-section of expected returns over and above market betas, a finding that challenges the validity of the CAPM. There are a number of possible explanations for such findings:

(i) The CAPM benchmark model was misspecified by the researchers possibly due to one or more of the following errors: incorrect choice of market index (Roll and Ross, 1994); failure to allow for time-varying betas and/or market risk premia (Jaganathan and Wang, 1996); survivorship bias due to data limitations (Kothari et al., 1995).

(ii) The market-to-book ratio captures some other risk factor, that cannot be captured by the CAPM.

(iii) The market-to-book effect reflects some form of long-lived mispricing of equities.

Bernard (1993) seeks to demonstrate that the clean surplus framework 'provides a new vehicle for tackling the debate'. The novel feature of Bernard's approach is his attempt to use the clean surplus framework to make testable predictions about the cross-sectional variance of market-to-book ratios conditional on the cross-sectional variance of accounting rates of return. His argument makes use of the following version of the clean surplus model:

$$\frac{P_t}{y_t} = \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t \left[(ROE_{t+\tau} - r)\frac{y_{t-\tau-1}}{y_t}\right] \quad (12)$$

where

$$ROE_t = \frac{x_t}{y_{t-1}}.$$

Equation (12) is derived from (3) by dividing through by y_t and rearranging terms. It represents market-to-book in terms of future abnormal accounting rates of return weighted by the projected growth ratios of future book values. To exploit this equation empirically, Bernard makes the following key assumption:

> 'Assuming that ex post observations of those fundamentals, when averaged over large samples, are good proxies for their expected values, the formula permits an assessment of whether observed price/book ratios are too variable.'

If this assumption is correct, then one can replace the expected values on the right-hand side of (12) by their realised values. This will then leave two further problems in implementing the model. First, one needs to impose some sort of finite terminal value assumption to deal with the fact that (12) involves an infinite summation. Second, one needs to assume an appropriate value for the discount rate. Bernard assumes a constant discount rate for all firms, zero growth beyond year 15, and a constant accounting rate of return equal to the average of years 11 to 15 for years 16 onwards. Given these assumptions, he calculates what the value of market to book should have been if the market's expectations had been equal to the realised values. This exercise produced a predicted range of market-to-book ratios that was appreciably smaller than the range of the actual distribution (the actual distribution had a range roughly between 50% and 100% of the estimated range).

Bernard's preliminary findings in this area are interesting but also difficult to interpret. The apparently high level of variation in market-to-book ratios could be due to mispricing but it could also be due to errors caused by deviations from the assumptions needed to implement the model. Bernard presents some evidence that suggests that the anomaly can be partly explained by cross-firm differences in discount rates and differences in accounting conservatism, but he also provides arguments and evidence suggesting that such factors cannot account for the high range of market-to-book ratios he observes. At this stage it would be foolish to claim that the clean surplus approach has delivered compelling evidence of mispricing. Nevertheless, the approach has provided a new way of thinking about the market-to-book puzzle.

9. Limitations of the Ohlson approach

9.1. Practical Problems

There are practical problems in implementing the Ohlson approach given that, at least in the UK, we have substantial deviations from clean surplus earnings. However, these practical problems are not destructive of the approach. Indeed, I suspect that some of the most interesting applications of the Ohlson model may come from identifying the effects of deviations from clean surplus earnings on accounting-based valuation models.

A good example of the kind of work I have in mind is O'Hanlon and Pope (1996). This paper uses the original accounts of 158 companies for a 20-year period to identify reported earnings and clean surplus earnings. Then, following Easton, Harris and Ohlson (1992), they examine the relations between stock returns and their two measures of earnings aggregated over time intervals of 1, 2, 5, 10 and 20 years. The authors argue that, in the long run, the market should discover the value relevance of any dirty surplus components of clean surplus earnings. Thus, if the dirty surplus items are value-relevant, the explanatory value of aggregate clean surplus earnings for long interval stock returns should be higher than the corresponding explanatory value of aggregate reported earnings. In fact, the authors find that aggregate reported earnings has higher explanatory value for stock returns over all five of the returns intervals they consider. The authors argue that such evidence questions the wisdom of recent regulatory efforts to discourage dirty surplus income reporting.

9.2. Aggregation Issue

Stark (1997) presents a simple extension of Ohlson's (1989) model which allows him to focus on the implications of partitioning clean surplus earnings into two additive components. He shows that special cases of his model arise where total clean surplus earnings is a valuation sufficient statistic for the two components. However, in general, total clean surplus earnings will not be a valuation sufficient statistic for its components. Moreover, there are other special cases of the model in which one of the two components will be valuation irrelevant. Stark concludes that the assumptions of linear information dynamics and dividend payment irrelevancy are not sufficient to imply a fundamental valuation role for clean surplus earnings.

9.3. Problems with the Measurement Perspective

Potentially the most destructive criticism of the Ohlson approach is that it does not explain why firms bother to report earnings and book values in the first place. Ever since Beaver and Demski's (1979) seminal paper, this line of criticism is one that has dogged all approaches to financial accounting based on notions of income measurement. However, it may be that this line of criticism applies with particular force to the clean surplus framework. Black (1980), for example, has argued that deviations from clean surplus accounting occur because this makes reported earnings a more valuable signal. Black's arguments are not rigorously formulated. However, Black's view of earnings is radically different from Ohlson's. The Ohlson models assume that accounting numbers reflect an underlying reality that is directly observed by the market. Black assumes that earnings *increase* the market's data set. In other words, share prices are better informed *because* earnings are reported.[14]

Having noted the 'Black' problem I should, in fairness to Ohlson, mention the possibility that the Ohlson approach may offer a new perspective on the Beaver and Demski conundrum. Specifically, it may be that attempts to rationalise income measurement have been shooting at the wrong target. Perhaps what we really want to know is why do we have financial reporting systems that supply measures of income (earnings) *and* value (book value)?[15] Perhaps one cannot hope to explain the basic features of the financial reporting system unless one starts from the proposition that capitalist owners value measures of return on capital. Viewed in this light, the question raised by Beaver and Demski (1979), which focused on income in isolation of capital, may simply have been ill-formulated.

Finally, it should be noted that neo-classical economics, because it is based on assumptions of perfect rationality, has nothing to say about how ordinary human beings achieve 'rational' outcomes. An important practical feature of accounting in general, and income measurement in particular, is that it provides 'adequate' small-dimensional representations of multi-dimensional economic problems. Viewed in this light, the essential message of Ohlson, and his followers, is that a two-dimensional representation of the firm (i.e. in terms of earnings and book values) is demonstrably superior to a single dimensional representation (i.e., in terms of earnings only).

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[14] The event study evidence on the market reaction to earnings news seems to support this view.

[15] A similar view is expressed by Brennan (1995), who writes: 'Therefore, in order to have a valuation model in which accounting earnings play a role, it is necessary to consider the balance sheet as well as the income statement.'

9.4. *The Assumption that Accounting and Disclosure Choices are Exogenous*

We have seen that MBAR is not the only way in which economics has impinged on accounting thought. Positive accounting theory has focused on issues of accounting choice, and information economics has shed light on a number of issues including financial disclosure choice. In broad brush terms these literatures have shown:

a) that accounting choice may not be independent of firm performance. For example, firms going through a bad patch may try to massage their reported profits upwards; and

b) that disclosure choices may also be related to current performance and/or the company's need to access funds for expansion.

The Ohlson and Feltham/Ohlson models assume that the information environment and the level of conservatism is exogenously given and constant over time. The models also rule out the possibility of financial decisions signalling new information to the market. Biases will arise in the estimation of the Ohlson models if firms' choices of accounting and disclosure/signalling are correlated either with share price performance or (uncreative[16]) accounting performance.

Lundholm (1995) shows, using simple theoretical examples, that the linear information dynamics assumed in Feltham/Ohlson (1995) cannot represent asymmetric accounting recognition criteria, such as the lower-of-cost-or-market value. Consistent with Lundholm's theory, Basu (1995) presents empirical evidence, for US firms, which shows that bad news tends to be recognised sooner in reported earnings than good news.

9.5. *No 'Births, Marriages, or Deaths'*

We have seen that the testable versions of the approach have assumed linear Markovian information dynamics. An implicit feature of this class of time-series models is that they have no beginning and no end. Firms are not born and they never die; they are also never taken over ('married').

Many firms come to market when they need finance to expand. Real options theory shows that many investment projects have a significant option to wait, and that projects are only introduced when they have a significantly positive NPV (see Dixit and Pindyck, 1994). If a significant proportion of newly-quoted companies comes to market when they are looking to finance positive NPV projects, the performance of the Ohlson model will depend on how recently firms went public. Technically speaking, the Markovian feature of the information dynamics assumption will be violated.

Black (1993) has presented evidence that suggests a change in the local valuation relationships when a firm becomes very unprofitable. In this region, the value of the shares is heavily influenced by the abandonment option implicitly available to limited liability shareholders. For such firms, the going concern principle, the conventional basis on which accounts are prepared, may be highly suspect, and a valuation based on the realisable values of the firm's assets may be more realistic. It may be possible to generalise the Ohlson framework to cope with this situation but, bearing in mind the options characteristics of the factors involved, it is doubtful if it will be possible to preserve linearity. Indeed, the recent papers of Dichev and Burgstahler (1996) and Hayn (1995) both present evidence of a non-linearity in the relation of prices and earnings. In particular, it would appear that the estimated earnings response coefficient of loss-making firms are not significantly greater than zero, while the ERCs of high profitability firms are roughly consistent with the theoretical value implied by assuming a random walk for earnings, i.e. 7 or more.

Firms may also be taken over. Moreover, for many firms their current value will impound a value related to the probability of being taken over. Again, the possibility of being taken over needs somehow to be factored into the Ohlson analysis. At the very least we need to allow for the possibility of survivorship bias in assessing the statistical performance of Ohlson models.

Specifically, one needs to take account of the fact that takeover premia tend to rise sharply in the 12 months leading up to a takeover.

It remains to be seen whether the Ohlson framework can be expanded to allow for life-cycle considerations in an empirically manageable way.

9.6. *The Convergence of Abnormal Profits Assumption*

O'Hanlon (1994) has questioned one particular feature of the information dynamics assumption, i.e. the idea that abnormal earnings follow a stationary stochastic process. He has produced plausible examples under which abnormal earnings cannot be made stationary even by differencing. O'Hanlon considers the implications of replacing the assumption of stationary abnormal earnings with an assumption that the accounting rate of return converges to some long-run value.

The problem with the approaches of Ohlson and O'Hanlon is that they are based on imperfect representations of the idea that, in the long run, competitive forces ensure that new projects earn normal economic returns. Perhaps a more promising approach would be to attempt to combine the cash flow information dynamics of Feltham and Ohlson with the idea that the net present values of capital expenditures revert to zero over time. Alternatively, one might refine O'Hanlon's idea of working with accounting rates of return, by abandoning historical cost based accounting rates of return and working with deprival value based accounting rates of return (see Edwards, Kay and Mayer, 1987).

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[16] Uncreative here means the performance that would have been reported if the firm had not engaged in creative accounting.

The analysis of Edwards et al., which is conducted entirely within a clean surplus framework, indicates that accounting rates of returns based on deprival value based book values should quickly converge to the costs of capital, given competitive product and factor markets. Moreover, the authors show how an ex post analysis of deprival value based accounting rates of return and stock market returns can contribute to an assessment of the extent to which a firm enjoys a sustainable competitive advantage.

10. Concluding remarks

The ideas of Ohlson and his co-researchers have provoked considerable controversy in academic accounting circles. Indeed, it is probably true to say that market-based accounting researchers had never experienced such a fundamental split in their ranks until the Ohlson framework started to gain influence. Ohlson himself encountered considerable resistance to his ideas from the established US journals and chose eventually to publish his seminal papers in *Contemporary Accounting Research*.

Part of the purpose of this review has been to attempt to take some of the heat out of this controversy. All mathematical models require simplifying assumptions designed to capture the essential features of a complex world, and the Ohlson models are no exception. The ultimate test of the Ohlson framework must be its empirical fruitfulness, and we have already seen that the Ohlson approach has led to MBAR models with superior statistical performance. However, the final section of this paper has raised a number of issues suggesting that it may not be possible to represent fundamental aspects of firm behaviour within the confines of clean surplus models based on linear information dynamics. The ultimate judgment on the Ohlson framework will turn on whether it can be generalised sufficiently to capture the essential aspects of these issues in an empirically-manageable form.

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ERRATUM

Depreciation Need Not Be Arbitrary

John Lane and Roger Willett

This article appeared in the Summer 1997 issue (Volume 27, No 3) of Accounting and Business Research, pp. 179-194. The following corrects an error which appeared in Table 2 in that article.

Table 2
Values of f(δ) for integer values of δ and γ = 1/θ

	δ									
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
γ										
2	1.000	1.166	1.175	1.147	1.114	1.084	1.061	1.043	1.030	1.021
3	1.000	1.211	1.252	1.239	1.211	1.178	1.148	1.120	1.097	1.077
4	1.000	1.237	1.300	1.303	1.284	1.255	1.225	1.196	1.169	1.144
5	1.000	1.254	1.333	1.348	1.338	1.315	1.289	1.261	1.233	1.207
10	1.000	1.291	1.409	1.458	1.476	1.477	1.468	1.454	1.436	1.417
15	1.000	1.305	1.437	1.502	1.533	1.546	1.548	1.544	1.535	1.523

$$\text{where } f(\delta) = \frac{(1-e^{-\delta\theta})^2}{1-(\delta+1)e^{-\delta\theta}+\delta e^{-(\delta+1)\theta}}$$

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Book Reviews

Corporate Governance: Responsibilities, Risks and Remuneration. *K. Keasey and M. Wright (eds.).* J. Wiley & Sons Ltd, Chichester, 1997. vii +176pp. £30.

This volume reports the findings from a series of studies that form part of a research programme into the financial aspects of corporate governance funded by the Research Board of the Institute of Chartered Accountants in England and Wales. The studies explore various aspects of accountability arising from the Cadbury Report, namely the extent and impact of institutional investor monitoring (Chapters 1 and 5), executive remuneration (Chapter 2), audit committees (Chapter 3), and internal controls (Chapter 4).

Individual chapters are structured as academic papers and display a broad spectrum of methodological styles. An introduction presents a framework for corporate governance and relates the volume's findings on the financial aspects of governance to the wider debate. This section also provides a useful discussion of the interaction between governance and enterprise. Unfortunately, with the possible exception of Collier's study of audit committees (Chapter 3), none of the subsequent studies explicitly addresses this issue.

In Chapter one, Short and Keasey examine whether the presence of institutional shareholders has a positive effect on the performance of UK firms. Their results are interesting in that they suggest the relationship to be a complex one. When considered independently of other ownership interests, no direct relationship between performance and institutional ownership is found. However, subsequent tests suggest that institutional ownership may have an indirect effect via its impact on the relationship between firm performance and managerial ownership. Further, the positive effect of institutional ownership on corporate performance is shown to occur only in the absence of other large external shareholders.

Chapter 2 explores the issue of executive remuneration. Ezzamel and Watson test whether pay awards in the post-Cadbury period are characterised by a strong pay-performance linkage, or whether external market comparisons are more descriptive. Results indicate that changes in executive pay are more closely related to external comparisons of pay levels than to changes in either profits or shareholder wealth. Further, they document evidence of an asymmetry in the treatment of under and overpaid executives: while underpaid executives in *t-1* experience significant pay increases in *t*, no comparable downward adjustment is observed for those executives who appeared overpaid in *t-1*. The empirical findings are interesting because they suggest that remuneration committees, rather than strengthening the pay-performance relationship, may simply act to bid up executive pay. A significant limitation of the study, however, is that only the salary and bonus components of executive pay are considered.

In Chapter 3, Collier explores the structure and role of audit committees in small listed companies (defined as those with a market capitalisation of less than £100m). The study comprises two elements: (a) a questionnaire to determine if differences exist between audit committees in large and small listed companies; and (b) an examination of the operation of audit committees in small companies via a series of case studies. Results indicate that while small companies are indeed forming audit committees, their composition and operation often fail to conform to Cadbury best practice. While both finance directors and non-executive directors generally expressed support for the formation of audit committees in small listed companies, all parties were quick to emphasise that the role of non-executives in such firms goes well beyond that of managerial control. Rather, non-executives are expected to add value to the firm through their business and/or City contacts. Clearly, this has important implications for board independence in small companies.

Chapter 4 addresses the question of internal controls. Mills surveys finance directors in the top 100 London Stock Exchange firms (by market capitalisation) and documents that in most cases, internal control is viewed as embracing both operating and financial control. Further, Mills reports that companies see risk assessment and management as essential aspects of internal control, and finds that the methods employed to control risk vary across sample firms. Unfortunately, no attempt is made to explain this variation.

Stimulated by the Cadbury recommendation that institutional investors should disclose their policies on the use of voting rights, the final chapter examines institutional investor proxy voting behaviour. Via a series of interviews with institutional investors, Mallin documents that most institutions claim to have a well-established policy of voting, particularly with respect to contentious issues. However, a survey of the top 250 UK firms (by turnover) indicates that institutional investor voting levels average only 35%. Additional analysis of the 20 largest institutional investors in each sample firm indicates significant differences in voting behaviour as a function of institution type, with insurance and pension-related holdings (unit and investment trusts) displaying the highest (lowest) voting propensity. The chapter concludes with a series of policy recommendations designed to increase the level of institutional voting activity.

With so much currently being written on corporate governance, many contemporary studies in this area offer few original insights. This volume contains sufficient new material to ensure that it does not fall into this category, but only just. The studies are generally well-written, although there is some repetition across individual chapters (e.g. the discussion of the free-rider problems associated with monitoring that appears in Chapters 1 and 2). In addition, several chapters lack a degree of structure and discipline with respect to the writing style. Interestingly, the editors choose not to identify explicitly the book's intended readership. One could argue that this lack of direction is reflected in the volume's content: the studies themselves (with the possible exceptions of Chapters 2 and 3) are not sufficiently novel or state-of-art to be much more than of marginal interest to the die-hard governance researcher; on the other hand, the book's remit is not strictly broad enough to provide the uninitiated reader with a comprehensive review of the current governance debate.

In sum, this volume represents a well-informed collection of studies from which all students of governance should benefit. On a final note, while reflection on the effects and recommendations of the Cadbury Report undoubtedly affords important insights into the issue of corporate governance, there is a danger that fixation with Cadbury will serve to constrain future governance debates. For myself, the most stimulating and informative parts of this book proved to be those instances when the focus shifted away from the Cadbury recommendations on to the more fundamental issues of management, performance and the governance mix.

Lancaster University — Steven Young

The Foundation: A History of the Australian Accounting Research Foundation 1966–91. *Geoff Burrows.* Australian Accounting Research Foundation, 1996. $25 (plus postage).

Commissioned and published by the Australian Accounting Research Foundation, this book celebrates its first 25 years of 'slow ripening' (see p. 191). Apparently, the Foundation and its sponsors, the Australian Society of Certified Practising Accountants and the Institute of Chartered Accountants in Australia, provided the author with access to their minutes and relevant correspondence. In addition, he was able to interview many of the key players.

Professor Burrows treads a fine line through the sources. His preface states bluntly that he wants to make heroes out of the (mostly) dedicated individuals who contributed to the Foundation's work. At the same time, he reserves the right to criticism and candour. Examples of both may be found throughout the book. Perhaps this is not surprising, given the institutionalisation of the rhetoric—and possibly even the reality—of independence in academia, accountancy research institutes and accounting practice, albeit in different modes and with varying degrees of actualisation.

The book may well be of interest to non-Australian readers with an interest in standard-setting processes or the management of professionalisation projects. As Burrows points out, the Foundation contrasts with its Anglo-American counterparts in at least two major respects. First, even 'after taxation research was jettisoned in 1983, the Foundation's remaining responsibilities—accounting standards, auditing standards and practice statements, and legislation review—gave it a broader research focus than its overseas counterparts' (p. 192; see also p. 51). Second, it has worked towards a tighter integration of public and private sector standards than either of its UK or US counterparts (see pp. 139, 165, 193).

Furthermore, the Foundation was a site through which significant tensions and forces flowed. The tensions apparent include those between: the Institute and the Society; the Foundation and its sponsors; academics and practitioners; accounting firms, on the one hand, and the Foundation, Institute and Society on the other; accounting and auditing standard-setters; standard-setters and 'preparers' (in both the private and public sectors); the profession and the state. The list of forces or movements includes economic booms and busts, inflation, deregulation, internationalisation and public sector reform.

The potential complexities are not theorised explicitly. Implicitly, the narrative hints at macro-economic drivers, captured by statistical indices of prices and growth and mediated through markets, political processes and significant events (sketched lightly in Chapter 1). In the foreground, individuals, organisations and institutions emerge as constrained but active players. They are agents acting upon principles, so to speak. A major part of Professor Burrows' story goes something like this: 'The company failures of the early 1960s occurred while the development of accounting principles remain fragmented and contentious. When supposedly profitable companies collapsed, existing principles appeared deficient, and the profession incompetent' (pp. 10–11). It is in this context that the Foundation emerged.

The mantra of 'more research' was heard within the two major accounting associations and a joint research organisation resulted (Chapter 3). But having formed it, the Society and the Institute were somewhat perplexed. They struggled to define its specific role(s) and its structure; to fund it, to staff it; to judge whether to leave it alone or look over its shoulder or compete with it. As the search for accounting principles mutated into the search for politically acceptable standards, the 'accounting profession struggled [until the late 1970s] to operationalise the Foundation's role while learning only slowly just what accounting research involved' (p. 191; see Chapters 4 and 5).

By then, state agencies were moving with increasing urgency into the emergent and contentious standard-setting arena. Institute, Society and Foundation struggled to define and hold their ground, not only in relation to each other, but also vis a vis state agencies which were, in their turn, cobbling together a national regulatory structure for corporations and capital markets. (In the background we have the oil price hikes and inflation of the 1970s; the boom and then bust of the 1980s; coupled with deregulation of capital and currency markets and 'reform' of the public sector. Somehow such events are fuelling the dynamics of the Foundation's world.)

It was under these pressures that the Foundation, under Kevin Stevenson and then Warren McGregor, managed to extract a vaguely reasonable allocation of funds and a sufficient complement of tuned-in and capable staffers. Increased scrutiny of its activities (from academics and the business sector as well as its sponsors and the state) came with the territory. Furthermore, its organisational structure remained unsettled in the face of both internal and external pressures. Even so, the Foundation's staff continued to 'perform', evolving into 'a professional research cadre' by the 1990s (p. 191; see Chapters 6, 9–12, 14).

By the mid-1990s the Foundation had become 'part of the nation's business regulatory apparatus' (p. 195) through the institutionalisation of its support role to the Australian Accounting Standards Board (a state agency), while still retaining 'an independent financial reporting voice through one of its own boards' (ibid).

Professor Burrows denies that the Foundation has been the home of an ivory tower clique manipulating its boards to produce unworkable standards. 'The alternative hypothesis is that the Foundation's boards have been generally populated by the cream of professional, commercial, government and academic accountants. This elite, albeit fallible, corps has been primarily responsible for all the controversial choices made in standards development. In this process, "commercial realities" have been balanced against theoretical integrity. Underlying this "compromise" approach, has been the implicit assumption that theoretical integrity represents a long-run financial reporting optimum. The narrative suggests that this alternative hypothesis is more cogent than the conventional view of the boards as ineffective pawns' (p. 199).

The last assertion seems questionable. The analyses of the fortunes of individual standards seem too thin to support it. There is often little theoretical or empirical analysis of the interests of, or incentives to, either the corporate players or the state agencies involved. Nor are the linkages between the macro and the micro elaborated in any depth. Rather, they are evoked, or alluded to. Nor is it clear how one could assess the claim to optimality. Have we been presented with an heroic historian's judgment, translated into economic jargon, claiming a degree of precision that is not really sustainable? Worse still, has Professor Burrows been 'captured' by his commissioners?

On re-reading his claim one might note that he is merely asserting that his hypothesis is 'more cogent' than that of the Foundation's critics. Their hypothesis is similarly problematic—more so than his own, Professor Burrows is suggesting. The stage has been set for further discussion.

If this particular issue does not appeal, there are many others. For example, the account of the rise and fall of current cost accounting in Chapter 8 provides a very useful account of a significant event in Australian accounting history. He has identified many relevant facts and sources, and his interpretation of the saga as the 'Foundation's Gallipoli', with 'its connotations of huge effort, noble failure and background manipulations by larger powers' (p. 111), deserves to be taken seriously. Seriously enough to be examined further by, for example, positive accounting researchers or critical students of the politics of standard-setting and professionalisation.

In short, this book can open up some interesting doors. It is written in a crisp and lucid style and enlivened with a dry wit. Nevertheless, I am tempted to quibble about the way biographical sketches are woven into the text. It is not that they are inherently trivial (a claim Professor Burrows denies in the preface). Rather, they sometimes seem to be inserted into the narrative just because a particular individual has moved on to the stage. The particular details disclosed at times distracted from rather than aided understanding of the drama then unfolding.

University of New South Wales Chris Poullaos

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